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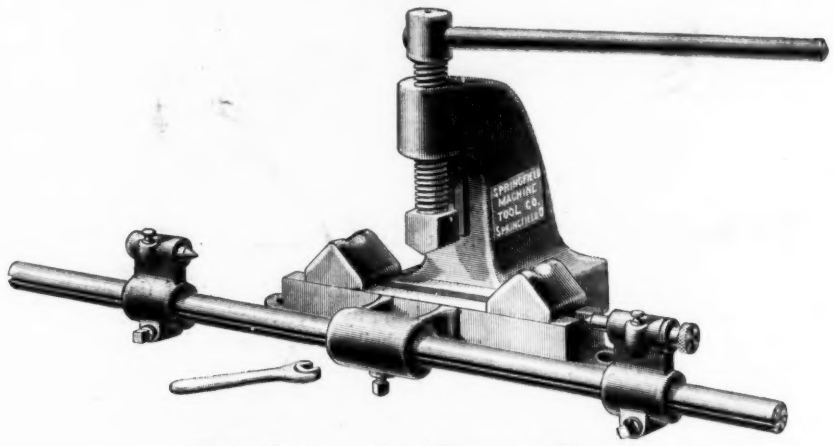
Bench Straightening Press and Centers.

The upper engraving on this page is of a machine, the uses of which will readily be understood by every machinist. It is intended to be placed upon the bench in the tool room or machine shop, and to be used when centering work by hand and for straightening work centered by hand or machine. It is a familiar fact that work straightened in a press is more likely to remain straight in the lathe than when hammered straight, and that it is better in every way. This machine, by bringing the centers upon which the work is tested, and the press by which it is straightened, together in the most convenient form, obviates the necessity of walking back and forth from the lathe to the anvil, block or press, and, in fact, has all the advantages for small work which the larger presses have for straightening shafting, etc. In the tool room it is especially valuable, not only for centering and straightening work in the rough, but for straightening pieces which have been accidentally sprung in use; or reamers, etc., which have been sprung in tempering.

The blocks upon which the work rests when being straightened, are movable to or from the screw, and are kept in line by tongues which fit the groove shown. The screw is 2″ diameter, 4 pitch, of steel, and sufficiently powerful to bend a 2″ shaft with ease. The shaft, upon which the centering heads are fitted, is cold rolled, 1¼″ diameter, 40″ in length. It is movable through the arm which supports it, being held in any desired position by the set screw shown, which has a piece of brass over its point to avoid marring the shaft. The centering heads are clamped in any desired position on the shaft by the binding screws shown. The top of the arm which supports the shaft forms a pocket for chalk or other material used in marking. The center at the right is pressed forward by a spring, and has a knurled head for drawing it back, both centers being provided with small oil wells, with brass fittings for convenience in oiling centers. The body of the machine has three lugs cast upon it, by means of which it is bolted to the bench. The block, which is on the end of the screw, is of cast-steel, case-hardened, and the centers of tool steel tempered—the whole machine being so designed and constructed as to make it worthy of a place and useful in any tool room or machine shop where much small work is turned. Its weight is 130 lbs., and it is built by the Springfield Machine Tool Co., Springfield, Ohio.



BENCH STRAIGHTENING PRESS AND CENTERS.

Straws that Denote the Direction of the Wind.

An Ottawa dispatch says:

The president of the board of trade of Quebec has addressed a communication to Sir John McDonald, asking the government to grant a subsidy for the establishment of a line of swift mail steamers between Quebec and Liverpool. The communication urged the necessity for the proposed line to compete with the line of mail steamers running between New York and Liverpool.

Our Canadian neighbors are alive to their interests, and no fault can be found.

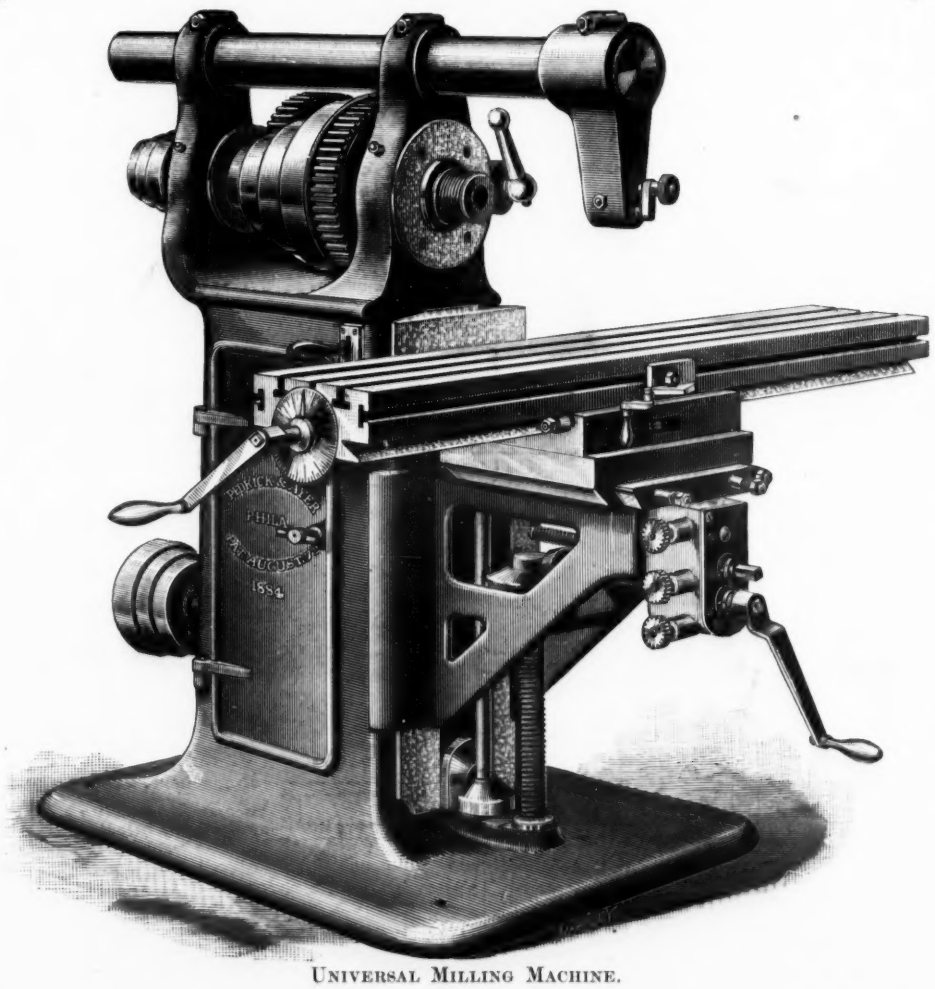
Universal Milling Machine.

We present herewith an engraving of a milling machine designed for tool or general machine shop work, which, while capable of doing heavy work, is yet useful for lighter work, such as is usually found in the tool room.

The gearing is made either internal or external, as may be desired, the internal being 4 to 1, the external 8 to 1. The machine is driven by a 3″-belt on a 4-step cone, the largest step of which is 11″ diameter.

The spindle is of extra quality hammered cast-steel, and runs in bronze boxes. The front bearing is 3″ in diameter and 4½″ long; back bearing, 2″ diameter and 4″ long, and provided with easy means of adjustment for wear. The front end of the spindle is threaded on the outside for face plates or face mills, and is provided with a taper hole for arbors, which is 1½″ diameter at the outer end, with a taper of ½″ per ft. A hole 1 1/16″ diameter extends entirely through it. A new form of adjustment is provided for the bronze boxes, by which they may be readily adjusted for wear without altering the original position of the spindle.

The cutter arbor supporting bar, with its adjustable center, can be moved out to support cutter arbors from the end of the spindle or pushed back out of the way, thus facilitating the milling or boring of a large piece of work that would be prevented by the ordinary fixed bar. It is 3¼″ diameter, and of solid cast steel, making a very rigid support. A harness is furnished for the bar, to fasten to the knee of machine when large cutters are used on extra heavy work—a feature that adds to its value, as can be readily seen.



UNIVERSAL MILLING MACHINE.

The three feeds, vertical, horizontal (in line with spindle), and traverse (at right angles to spindle), are all *reversible*, and are operated or stopped altogether by the handle shown in the cut near the closet door. This reversing device is common to engine lathes, does away with the crossing of belts, and saves time. The 3-step cone on the spindle belts to the lower cone, the shaft of which runs in a hollow stud, and drives, by means of the reversing device referred to above, a shaft running through the base of the column. Bevel gears connect this shaft with the vertical shaft, and the latter by bevel gears with the horizontal shaft in the knee, which communicates in turn with the several screws for the various feeds in the front of the knee by clutch gears. These clutch gears can be engaged or disengaged at will by the knurled knobs shown in front, giving a vertical or horizontal feed. The platen feed is operated from the upper shaft in the knee by means of a pair of mifer wheels running in a bearing which is a part of the platen slide on the knee. A vertical stud passes upward to the long screw in the platen, and is connected to it by clutch miter wheels. The screw in the platen is splined, and can be engaged and disengaged by a clutch lever, shown in the cut, convenient to the operator.

The platen is 48 inches long, 9¼ inches wide, and has two slots for ⅝-inch bolts on the top and on the edges two slots. The latter are very useful and convenient. The platen has a transverse feed of 33¼ inches and a horizontal feed of 7⅞ inches. It can be turned completely around and fed in line with the spindle. It has an automatic stop, while feeding in either direction, and is secured by four ⅝″-steel bolts in the swivel base, of easy access with a wrench.

The knee is so designed and constructed as to withstand all strains liable to be brought upon it. It has a bearing 17″ long and 10½″ wide.

The feed gearing is well protected from dirt, and the mechanism is not liable to disarrangement. All gears and screws are of steel, and are accurately cut. The dials read in decimals, or divided by 2, 4, 8, etc., enabling any measurement to be made.

To the scraped surface which surrounds the front spindle bearing, an attachment may be fastened, which has a supplementary spindle for carrying a milling cutter, drill, or other boring tool, and which may be fixed at any desired angle to the platen.

The machine weighs about 2,600 lbs., and is built by Pedrick & Ayer, Philadelphia, Pa.

The Modern Steam Plant and its Management.

BY PETER H. BULLOCK.

GETTING UP STEAM.

Before we do this, however, let us take a careful look inside the boiler, first, to see that the braces, pins and fusible plug are all right, and secondly, to make sure that no

one has left any tools, waste, overalls or other miscellaneous articles therein. This is of more importance than most people are aware of. On two different occasions the writer came very near serious trouble from things being left inside a boiler. The first was from a very hard piece of rubber gasket that came from the manhole plate, and which lodged in the blow-off cock in such a manner that it could not be closed. This is not a desirable fix to be in, and it is a good idea to think these things all over, and what to do if such and such things should happen. In this case, by crowding the pump and covering the fire, I managed to cool the escaping water, so that I was able to "spike" the end of the pipe with a long plug. There are a good many places where the pipe is not exposed, and if it were so, we might not be able to cool the water so as to get in a plug. It is far better to be sure there is nothing in the boiler that does not belong there.

The other occasion was more serious, but in another direction. A boiler had been open for cleaning and inspection, and was closed up again after positive assurances from the man who had scraped the heads of an accumulation of greasy rust, that he had left nothing in it. Directions were given the attendant to blow down two gauges after steam was up, and again in the afternoon. The first blowing was done in my presence, and all was right except a small leak in the cock that was to be repaired the first time the boiler was cold. At four in the afternoon, the attendant came and said he could get no water out of the boiler. On going to the place, this was found to be a fact; not a drop appearing at the end of the pipe. On jarring the pipe to see if it would not start, I noticed that it was loose in the brickwork, and on pulling, it came out towards me some inches. Now, when you are not sure what is keeping back ninety pounds' pressure of hot water, but are sure that a two-inch pipe has parted and is pointing your way, it makes a fellow feel a little uncertain about what will happen next. Perhaps an illustration (Fig. 1) of how things looked may impress on the minds of all who read this and ever enter a boiler, the importance of taking an account of stock on coming out. If an inventory had been taken when my man came out, there would have been a certain handful of greasy waste found to be missing, and a diligent search would have found it in the boiler that I had been assured was all cleaned out, and the writer would have been spared two hours of high-pressure anxiety. The dirty piece of waste had nestled right down over and into the pipe, closing it tight. If the blow-off cock had been perfect, the waste would probably have been kept blown back by the steam that the enclosed water would have made, but, the cock being a little leaky, permitted the waste to settle down good and solid. Quite likely it was fortunate that it settled there instead of over the fire, for in the latter case we should have had to face something that would have looked like Fig. 2, or perhaps worse.

All boilers should be fitted with vacuum valves, and nothing is better for this purpose than a common check valve. All that is necessary is to fit a light spring under the seat—just enough to lift the valve, and attach it to the boiler, or to the main pipe near it, with the opening inward, so that when steam goes down the air can go in. If a boiler is fitted with one of these valves, it will prevent that peculiar procession of air bubbles that can be seen rising through the glass gauge when the boiler is being filled, and which frequently deceives or alarms an unskilled attendant. The spring serves the purpose of holding up the valve when getting up steam, and allows the air to escape instead of passing with the steam to the condenser, if low pressure or compound engines are used, or to the radiators, if the steam is used for heating. The valve should be about ¾ inch or 1 inch in size, and the spring weak enough to allow the valve to close at one pound or less.

A case once came to my notice where a boiler was ruined, which could not have occurred had it been provided with a valve as above described. It was located in a city basement, and the blow-off pipe entered the sewer at a height about even with the usual water line in the boiler. One Saturday night the engineer opened the blow-off cock and went away, leaving the boiler to empty itself. When he visited the place Sunday, he found the boiler full up to the second gauge, and thinking that the watchman had filled it, he allowed it to remain so, closing up the blow-cock, which he supposed the watchman had

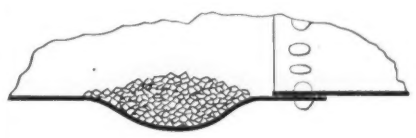


Fig. 2

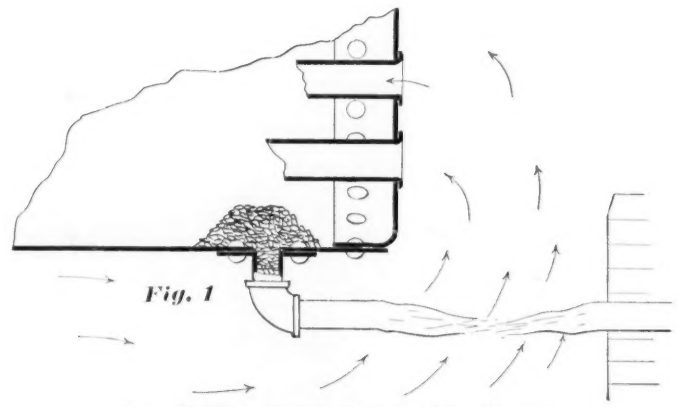


Fig. 1

THE MODERN STEAM PLANT.—SEE PAGE 1.

neglected to do, and charged the furnace with wood, ready for starting. Before the fire had burned an hour Monday morning, the shell was a perfect wreck, being bagged in three places, and the seams leaking badly. The cause of the trouble was this: at the time of blowing off it was high tide, the sewer being full at such times, and after the water had all blown out of the boiler, it began filling again, sucking in the mixture from the sewer. It probably filled itself full and then settled down to the level of the blow-pipe, or where the engineer found it. Perhaps there was never before as large or filthy a deposit found in any steam boiler as there was in that one when opened. Dock mud, paper and debris of all kinds covered the shell from end to end, and when the fire was built, of course there could be but one result—bagged and cracked sheets. Very few boilers are piped so that a similar accident could happen to them; still, there are none but are far safer with a vacuum valve than without one.

Considerable difference of opinion exists among engineers in regard to getting up steam; whether the fire should be run moderately and the heat slowly imparted to the boiler and its contents, or whether steam should be made as soon as possible. There is no question but what there are great strains put on parts of a boiler when filled with cold water and a fire built in the furnace, and some logically

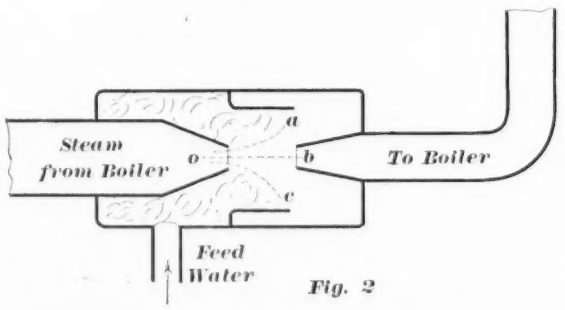


Fig. 2

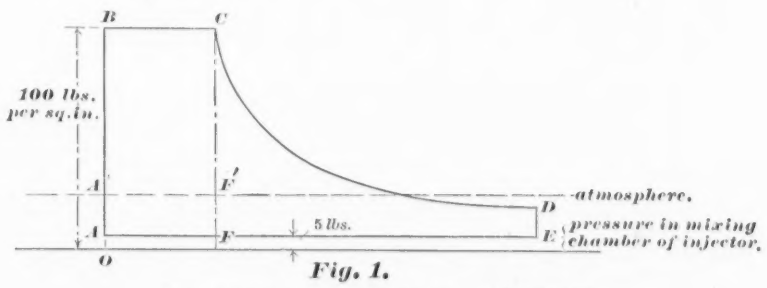


Fig. 1.

DISTRIBUTION OF ENERGY IN AN INJECTOR.

contend that it is better that the admitted strain be of as short a duration as possible. There is something to be said on both sides: If the fire is run closed up and the heat gradually imparted to the boiler, there will be less strain from unequal expansion of its parts than there would be if the fire were crowded. But, on the contrary, if a slow fire is run, the temperature in the tubes will be so low that there will be a large condensation of the gases in them, and probably nothing is more corrosive than this compound of creosote and carbonic acid. Of the two evils, I should prefer the first, and allow the fire to burn brisk enough to quickly raise the temperature in the tubes, sufficient to prevent condensation in them. When boilers are first set, or the brickwork newly repaired, the furnaces should be slowly dried out by light fires of wood or shavings.

It is doubtful if anything strains a boiler as bad as filling it when hot, and surrounded by still hotter brickwork. Here we have a reversal of the conditions that exist when getting up steam. Then the boiler is filled with water that quickly absorbs the heat that passes through its ports, and the whole body of water soon becomes of the same temperature by its circulation. In the case of filling a boiler, however, the shell may be far hotter from contact with the surrounding brickwork than it was when the water was blown from it. Now, when cold water strikes any part of the boiler, the heat of that part is instantly taken up by it, while the surrounding parts retain the heat until they are in turn covered by the rising water. Here we have most pronounced unequal expansion, and subject a boiler to dangerous strains. A hot boiler should never be filled with cold water, nor a cold boiler with hot water. Where several boilers are used, it is quite often possible to fill a hot boiler with hot water through the heater, as with an injector, and without injury to it; in fact, it is by far the best way to do when possible, as it prevents the moisture in the tubes before referred to, when the fire is started.

An engineer (?) recently told the writer that he was able to always have the water in his boiler hot, and that once he had five pounds of steam the next morning after fill ing his boilers with cold water, from the heat contained in the furnace and setting. I also ascertained that the fusible plug was filled with the best quality of babbitt metal.

It looks as if the heading of this article should have been "Getting Ready to get up Steam," as, owing to anecdote and argument, little has been said on the subject announced.

It is my intention next time to say something about pumps and boiler feeders in general.

Boiler Explosions in Germany.

In Germany, during 1887, there were thirteen boiler explosions, the Germans making up in destructiveness what they lack in numbers of these incidents.

By the thirteen explosions seventeen persons were killed; five seriously and fifty-nine slightly injured. One of these explosions was, so far as known, the most destructive that ever occurred. A battery of twenty-two boilers, at the blast furnaces of Friedenshutte, Silesia, exploded, completely demolishing the boiler house, setting fire to a number of other houses by throwing red-hot bricks, killing ten persons and wounding fifty-two.

On the Distribution of Energy in an Injector.

BY PROFESSOR J. E. DENTON.

The deduction recently made by Prof. J. B. Webb,* from the principle of the "conservation of the motion of the center of gravity," regarding the physical reason for the low efficiency of an injector as a pump, affords a direct answer to a question which has long interested students of the injector, namely, admitting that the injector, radiation excepted, loses no heat, or that its efficiency as a boiler feeder is perfect, why is it that it is capable, as a pump, of performing a duty of only 2,000,000 foot pounds, while a small, direct-acting pump, using steam with the greatest practical degree of wastefulness, can perform five times as great a duty, or 10,000,000 foot-pounds. The deduction drawn from the theory of center of gravity referred to is that, in the injector, a pound of steam, colliding with 13 pounds of water, practically at rest, the product of the velocity of the steam times its weight must equal the product of the weights of the steam and the 13 pounds of water into their joint velocity after impact, and that therefore the latter velocity is $\frac{1}{14}$ of the velocity of the steam. So that the vis viva of the moving mass of water after the impact with the steam against the water will be represented by the product of half of the mass of 14 pounds times the square of $\frac{1}{14}$ of the velocity of the pound of steam before impact. But this product is just $\frac{1}{14}$ of the vis viva of the pound of steam before impact. Consequently, $\frac{13}{14}$ of the energy in the steam, as it enters the injector, is transformed by impact into heat, leaving as a maximum only $\frac{1}{14}$ available to force open the check valve of the boiler and perform the mechanical work of feeding similar to that performed by the piston of a pump.

The discussion of the distribution of energy in an injector by equations of momentum is nothing new. All mathematical discussions of the instrument have presented such equations.

For example, as is well known to American students, these equations appear in the little Science Series Volume by M. Leon Pochet.

But it has never been deducted from these equations, in plain terms, why the injector, which, under the law of momentum, may at first use steam to the full limit of expansive action, finally realizes a mechanical result of far less value than a pump whichs acts without expansive action. To illustrate: If an injector works with steam of 100 lbs. absolute pressure, the law of vis viva which governs the flow of steam requires that the work which the steam devotes to the action of the injector shall be the area $A\,B\,C\,D\,E\,A$, which is the same work that a steam engine, expanding 20 times, would theoretically realize from an expenditure equal to the total heat of the weight of steam represented by the volume $B\,C$. On the other hand, a steam pump, working without expansion, would realize from the same expenditure of heat simply the useful work represented by the area $A\,B\,C\,F\,A$.

Now, assuming that in the pump there is neither loss by clearance nor cylinder condensation, the area $A'\,B\,C\,F\,A'$, if $B\,C$ represented a pound of steam, would be $(100 - 14.7) \times 144 \times 4.3 = 52{,}818$ foot pounds, 4.3 cubic feet being the volume of a pound of

* Paper read at the Scranton Meeting of the American Society of Mechanical Engineers, October, 1888.

steam at 100 pounds pressure per square inch.

On the other hand, the area *A B C D E A*, *O A* being assumed to be 5 lbs. pressure per square inch, is 156,542 foot pounds, or fully 3 times as much effect as the pump for the same expenditure of heat.

But as a matter of fact, the best practical duty * of an injector is about 2,000,000 foot pounds against 10,000,000 for a direct-acting boiler feeding size of pump.

In other words, the practical pumping effect of the pump is five times that of the injector. What has become of the great superiority of the injector, which the equations of vis viva and momentum indicated, should be as 3 to 1? It is not due to radiation, for this loss is greatest in the pump. It cannot be anything akin to cylinder condensation and clearance, for these effects exist only in the pump, and there cause the enormous waste of over $\frac{1}{2}$ of the total feed water and yet it exceeds the injector in efficiency. It is directly from this point of view that Prof. Webb's deduction comes to our rescue, by showing us that, although the injector may and does initially endeavor to devote three times more of the heat in the steam to mechanical pumping effect, yet, because such effect has to convey itself to the feed water by impact, not less than $\frac{13}{14}$ of the work represented by *A B C D E A* can avoid being changed back from the form of mechanical work into heat, when the mass of swiftly moving steam collides with a mass of water 13 times as great as is the case under the most usual conditions of the working of injectors.

Instead, therefore, of realizing 156,540 foot pounds from the expansive area *A B C D E A*, we have only $\frac{156,540}{14}$ = about 11,000 foot pounds. Without the effect of cylinder condensation; we therefore have by Prof. Webb's theorem: Useful effect of injector = $\frac{11,000}{52,818}$ = about $\frac{1}{5}$ of pump.

But, as the cylinder condensation in the case of the pump is known to reduce its efficiency by at least one-half, we have, by Prof. Webb's theorem, including cylinder condensation in the pump: Useful effect of injector = $2 \times \frac{1}{5} = \frac{2}{5}$ of pump.

This result is now again inconsistent with practice, because we have stated that by experiment, useful effect of injector = $\frac{1}{5}$ of pump.

But Prof. Webb further points out that, unless the directions of the particles of steam at the instant of striking the water are exactly parallel with the direction of the flow of the feed water—only a fraction of the $\frac{1}{10}$ part of area *A B C D E A*, Fig. 1, will remain as mechanical effect. Now it is quite reasonable to suppose that many particles of steam rush from the steam pipe *O*, Fig. 2, in directions *o a*, *o c* oblique to the direction *o b*, and it is only necessary to suppose that about 50 per cent. of the weight of the steam does so act in order to bring the theory into harmony with expermient in assigning to the injector $\frac{1}{5}$ of the useful effect of a pump, considering the injector *as a pump only*.

The following table † shows the actual ratio of the injector to the pump as a boiler feeder, giving it full credit as a feed-water heater as well as a pump.

TABLE I.

General conditions:

Pressure of steam in boiler, 80 pounds per square inch above the atmosphere.

The boiler fed in one case by a direct-acting steam pump, having a duty, when no feed water heater is used, of 10,000,000 foot pounds per 100 pounds of coal, and in the other by an injector which heats the feed water from 60 deg. to 150 deg. Fahr.

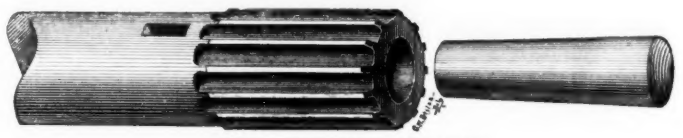
Temperature of feed water as delivered to the pump or to the injector, 60 deg. Fahr. Rate of evaporation of boiler, 10 pounds of water per pound of coal from and at 212 deg. Fahr.

METHOD OF SUPPLYING FEED WATER TO BOILER.	Relative amount of coal required per unit of time, the amount for a direct-acting pump feeding water at 60 deg. without a heater, being taken as unity.	Saving of fuel in per cent. of amount used if the boiler is fed by a direct-acting pump, without heater.
		per cent.
Direct-acting pump, feeding water at 60 deg. without a heater	1.000	.0
Injector feeding water at 150 deg., without a heater	.985	1.5
Injector feeding water through a heater in which it is heated from 150 to 200 deg.	.938	6.2
Direct acting pump, feeding water through a heater, in which it is heated from 60 to 200 deg.	.879	12.1
Geared pump, run from the engine, feeding water through a heater, in which it is heated from 60 to 200 deg.	.868	13.2

Conclusion: By Prof. Webb's theorem it appears that, while the injector, considered as a pump, at first permits steam to work with the full advantage of expansive action, and thereby transforms a greater per cent. of heat into work than a pump, yet all such advantage is lost by the re-transformation of about $\frac{87}{88}$ of the expansive work into heat by oblique impact, thereby making the efficiency of an injector about $\frac{1}{5}$ of a non-expansive steam pump, notwithstanding that such pumps waste over twice as much steam by cylinder condensation as is necessary to fill their cylinders.

* By the term duty is here meant the popular measure of the efficiency of pumping machines, viz., number of foot pounds of useful work per 100 lbs. coal consumed.

† From article on "Efficiency of Pump versus Injector," by Prof. D. S. Jacobus.—See Stevens' *Indicator*, April 15, 1888.



A NEW ADJUSTABLE REAMER.

A New Adjustable Reamer.

Amongst machinists it is a well recognized fact that solid reamers will ream holes more nearly alike and usually smoother than can be reamed by any kind of an adjustable or expanding reamer. And yet, for some work, solid reamers so quickly wear below the limit of allowable variation as to make their use practically impossible. The engraving accompanying this shows a reamer devised by our contributor, J. E. McConnell, of Des Moines, Iowa, for overcoming these difficulties and providing a reamer which shall possess all the well-known advantages of a solid reamer, and yet be adjustable. The plan consists in welding a steel shell over a round iron bar. The reamer is then made in the usual manner, the flutes cutting through the steel to the iron center. A taper hole is made in the end of the reamer, to which a steel pin is fitted and allowed to project $\frac{1}{2}$" more or less, according to the size of the reamer. This hole is made sufficiently large, so that the remaining iron may be readily stretched and expanded by driving the pin with a hammer. A slot is provided, by which the pin may be drifted out when necessary.

With the taper pin driven firmly home, this reamer is to all intents and purposes solid; yet, when worn below size, it is only necessary to drive the pin slightly to restore it. Mr. McConnell, who has just received letters patent upon the reamer, writes that they have been in use in the establishment where he is employed, for about six months, and that they consider them the best reamer yet made.

Steam Pipe Arrangement.

BY W. H. BOOTH.

When a pair of engines are connected upon one shaft, it is very common—indeed, almost universal—to find that the steam pipe from the boiler is led up to the engines as in the sketch Fig 1, where *a* is the main pipe from the boilers, and *b* and *c* the branches to the engines respectively. The faultiness of this arrangement has been frequently brought to the writer's attention, when indicating engines, by the comparative freedom from water at the indicator taps of engine *b*, whilst frequently, on opening the taps of engine *c*, the amount of water has been very great, and the working of the indicator much impeded. It is an elementary law of motion, that a body in motion tends to continue in motion in a straight line infinitely, and it will do so unless some new external influence is brought to bear, to modify such motion.

Yet this tendency of matter is very largely overlooked by engineers and designers, and notably in the arrangement of steam pipes of which our sketch is an example. Almost every boiler delivers its steam with some entrained water, and necessarily such water is carried along at the same velocity as the steam. A large volume of steam has very little weight, but is endued with a self-contained energy of expansion, which causes it to quickly take a right-angled turn without any great hindrance from the law of motion above quoted. Hence, in the sketch, steam from the boilers advancing up the pipe *a* turns readily to fill the pipe *b*, and such steam as does not flow to *b* passes on to *c*. The water hurried along the pipe *a* has, unlike the steam, no expansive power, and simply tends to preserve its forward motion and the bulk of it passes the opening *b* before it can be sufficiently bent out of its course to enter. Once past the opening, it cannot return, but is carried forward by the steam to *c*, and after dashing against the blank flange *f*, has no choice but to enter the pipe *c* and pass through the cylinders of this engine. Consequently, engine *c* gets not merely its own share of water, but also that of its fellow engine.

If, however, a turn-down bend is attached in place of the blank flange *f*, with a suitable receptacle for water, it would be found that the steam to engine *c* would be almost as dry as that to engine *b*; for the water, obeying its natural tendency to preserve its forward motion, would continue past *c* and collect in the receptacle below *f*, from which a suitable drain pipe would convey it to the boiler feed.

When the exhaust injector was first introduced, one argument brought as an objection to its use was, that, using exhaust steam from an engine, it would be the means of introducing grease into the boilers—a very objectionable ingredient to put into a boiler.

The makers of the exhaust injector found that it did not act so when properly arranged, and experience taught them that the way to lead away the steam from the exhaust pipe to the injector was as shown in Fig. 2, where *E* being the exhaust pipe, *g* is the supply to the injector taken off at a square-shouldered bend in a just contrary manner to that first anticipated, for the at first sight proper method was to facilitate the entry of steam to the injector. With the arrangement as per Fig. 2, the oil particles simply rush past the opening *g*, into which dry steam alone flows, and the injector being simply a heat engine, works better and more economically with dry than with wet steam, and the device of Fig. 2 is only a repetition of Fig. 1.

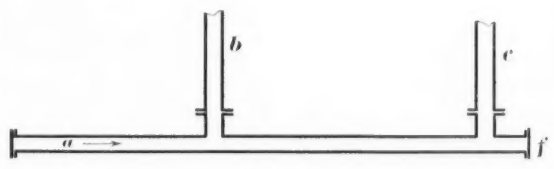
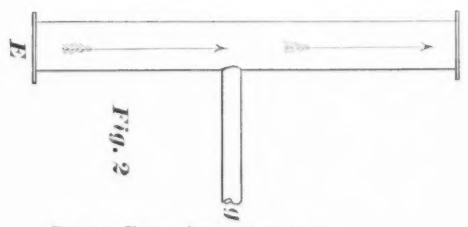


Fig. 1



STEAM PIPE ARRANGEMENT.

Further application of the principle of inertia will teach that, when a steam pipe leaves a boiler, it should be as large as conveniently practicable, so as to reduce the velocity of inrush of the steam, and prevent it from carrying in water; once entered in the steam pipe, the water will be carried forward, and hence the uselessness of giving steam pipes a slope back towards the boiler, under the mistaken idea that entrained water will flow back thereto; for it will not.

Once away from the boiler, we should reason that the diameter of the pipe should diminish, not by steps, but by tapered lengths to the smallest consistent with the attainment of boiler pressure on the piston, in order that the velocity of any entrained water may be great at the last bend, which should always be a square bend with an added water-catcher, as at *f* in Fig. 1.

The application of complicated apparatus for the riddance of water is expensive and unnecessary, and after all is only valuable in so far as use is made of the principle of inertia of moving particles, and such principles are as readily utilized by a common sense application, such as exists at *b* in Fig. 1, or at *g* in Fig. 2.

The loss of efficiency from one right-angled bend in a steam pipe is small. All other bends should be avoided, but if unavoidable should be curved. It must not be overlooked that, in passing a curved bend, the centrifugal inertia of the water will cause it to take the outer side of the bend. Hence on a circular bend, any branch pipe should always be taken off from the inside of the curve. Other applications of the same principles will present themselves to the reader; the only one to which we will draw attention is in the arrangements of the ports of a steam cylinder when four in number, as in the Corliss engine.

The steam port should of course be on the top of the cylinder, and should deliver its steam directly across the cylinder into the exhaust port on the bottom. There is then the chance that any water still in the steam will be shot directly into the exhaust port, and be carried out of the cylinder as soon as the valve opens for release, and before it has undergone re-evaporation.

Those who have had some opportunities of observing the methods of some of the prominent inventors of our time, will be able to appreciate the following extract from Henry Guy Carleton, published in *The World*:

"Most of the daring and original inventions we are going to push are little ideas of my own, dashed off at odd moments while coming down town every morning on the horse-car after reading the morning papers. After getting the idea, I jot down the title of the invention in a small sealskin book I carry for that purpose, and then try to forget it, so as not to weary my brain. Most inventors sit up late at night and fret themselves into a low fever trying to find a way to make the inventions work. I do not. I limit myself to conceiving the scheme. Thus, yesterday I thought of the 'Automatic Seidlitz Powder and Boot-blacking Machine,' so constructed that, if a nickel is dropped into the slot, the customer gets a seidlitz powder inwardly and an elaborate polish outwardly, without delay. This new idea, so strikingly simple and ingenious that it is almost a miracle that no one ever thought of it before, I turned over to our corps of German mechanics and our patent lawyer, who attend to the few little mechanical details incident to getting up the machine. I never bother with wheels, levers, pinions, springs, trunnions or ratchets. A good German mechanic, costing only $4.00 a day, is capable of solving the simple problem of making a machine to do a given class of work, and when he has done it the patent lawyer files an application in my name. It will thus be seen that I follow in

the path of the most prominent inventors of the day. My fertility is amazing, even now, when I only have six German mechanics and one lawyer; but after February, when I shall have twenty-two German mechanics and three lawyers, I expect to quadruple my fertility."

Boring Cylinders with the Bar Out of Line.

BY FRED J. MILLER.

Amongst the letters from practical men this week will be found one relating to the frequently discussed subject of the effect of setting a lathe out of line when boring a cylinder. There are a goodly number of lathe hands who find it hard to understand why it is that, when turning a shaft with the tail center set over, the work will be round, but tapering, while when boring a cylinder, using a bar with a fixed cutter, and with the tail center set over in the same manner, the bore will be neither round nor tapering, but elliptical, and the same size at one end as at the other. As this matter is so often discussed amongst machinists, and seems to be so often misunderstood, a discussion of it, with an attempt to explain the principles involved, may prove interesting to many.

Perhaps the most familiar object which will serve as an illustration of the principle involved is the common stove pipe damper, which is simply a disk, usually made of cast-iron, equal to the diameter of the pipe in size, and so arranged as to swing upon pivots to partially or wholly close the pipe. When a damper of this kind stands square in the pipe, it closes the pipe up, but, if turned either way from this position, it touches the pipe at two points only, these points being diametrically opposite each other, where the axis passes through, the pipe being open more or less at all other points. Looking into the pipe, when the damper is in this position, we would see something like Fig. 1, in which the outside circle represents the edge of the pipe, while the ellipse drawn inside of it shows the form in which the round disk of the damper would appear when tipped back, to partially open the pipe. It is a true ellipse, because it is the projection of a circle at the given angle, which we know produces an ellipse, though the demonstration of that fact need not be repeated here.

Now it is evident that if, letting the damper remain in this position, we close up the pipe at the top and bottom, and make it again fit the damper, the pipe will be no longer circular, but will be elliptical in shape. It is for precisely the same reason that a cylinder will have an elliptical bore, if the plane in which the cutter revolves is at any other than a right angle to the center line of the cylinder. The plane in which the cutter revolves must always necessarily be at right angles to the center line of the bar, and therefore it can only be at right angles to the center line of the bore of the cylinder, when this line and the center line of the bar coincide. In speaking of the center line of the bar, I here mean the line drawn from one center of the lathe to the other, and about which the bar turns, regardless of whether the bar itself runs true or not.

The above proposition will be made plain by an inspection of Fig. 2, where a longitudinal section of a cylinder is shown, which is supposed to be in the lathe, and being bored by a bar having a fixed cutter, and set at an angle, as shown. The extreme cutting point of this tool will, of course, describe a true circle, and this circle we may imagine to be the edge of a disk corresponding to our stove pipe damper. The position of this disk, with respect to the bar and the cylinder, is indicated by the dotted line which is drawn through the cutter at right angles to the center line of the bar. This imaginary disk, the edge of which is traced by the point of the cutter in revolving, is not at right angles to the center line of the cylinder, and consequently it would not fit the bore if it were round, for the same reason that the damper does not fit the pipe unless it stands square.

The projection of this imaginary disk at the given angle will be an ellipse, the proportions of which are shown at a, in the end view, Fig. 2. It is evident, therefore, that a cylinder bored with the bar at this angle will not have a round bore, but an elliptical one, of the proportions shown at a, which is just the form in which the imaginary disk would appear when viewed upon the line $c\ l$, which is the center line of the cylinder, and parallel with the shears of the lathe.

But if there is a sliding head upon the bar, instead of a fixed cutter, then the sides of the bar become the guiding surfaces, instead of the lathe shears, and the center line of the bar and that of the cylinder must always coincide, and the bore will be round, because our imaginary disk will, of course, always be at right angles to the bore.

This is shown in Fig. 3, where it may be supposed that a hole is to be bored through the cylinder with its center line in $c\ l$, but instead of setting the bar on that line, suppose it to be set as shown, then the bore will follow the dotted lines parallel to the bar, instead of following the line $c\ l$, as in Fig. 2.

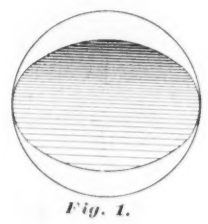


Fig. 1.

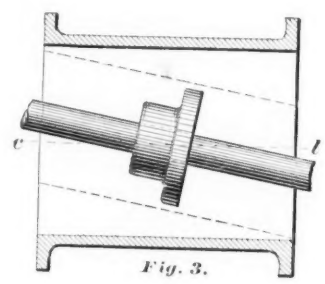


Fig. 3.

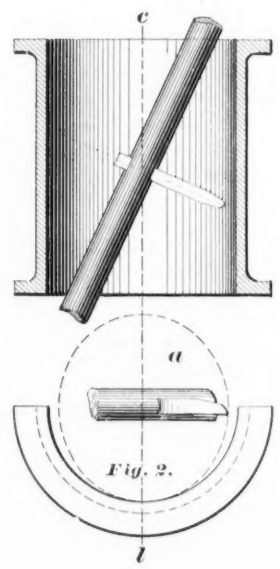


Fig. 2.

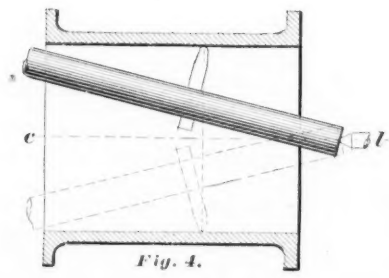


Fig. 4.

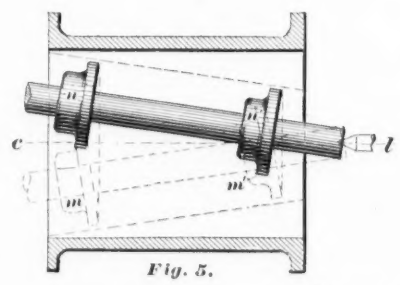


Fig. 5.

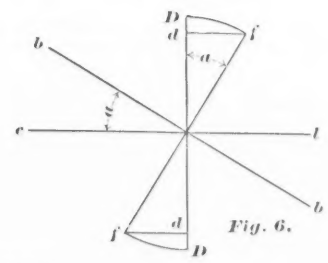


Fig. 6.

BORING CYLINDERS.

A little reflection will show that throwing one end of a bar out of true, as mentioned by Mr. Platt, is an altogether different matter, and in the case of a bar with a fixed cutter, affects nothing except the size of the bore, as is shown by Fig. 3, where a bar of this kind, turning upon a fixed center at one end, and thrown out of truth at the other, will, in one part of its revolution, be in the position shown by the full lines, and, when it has made half a revolution, will be in the position shown by the dotted lines, but the real center about which it turns will not be changed at all, but will continue to lie in the line $c\ l$, which will coincide with the center line of the cylinder, and the bore will be cylindrical; for, the cutter will revolve in a circle of unvarying diameter, and the plane in which its point revolves will be represented by the dotted line, which is at right angles to the center line $c\ l$.

But if a bar having a sliding head be thrown out in the same manner, the result will be a taper or conical bore, as shown by Fig. 5.

When the head is in the position $n\ m$, it will bore larger than when in position $n'\ m'$, but the bore will still be round, because the plane in which the cutter revolves, designated by the dotted lines, will always be at right angles to the center line $c\ l$.

The proportions of the ellipse described by the cutter, when the bar is set at an angle, as in Fig. 1, may be determined graphically by the diagram, Fig. 6, where $c\ l$ represents the center line of the lathe, $b\ b$ the center line of the bar, and a the angle between them. The line $D\ D$ is drawn at right angles to the line $c\ l$, and the line $f\ f$ at right angles to $b\ b$. The line $f\ f$ consequently represents the plane in which the cutter revolves.

Taking the intersection of these four lines as a center, and with a radius equal to the distance from the center of the bar to the extreme point of the cutter, describe the arcs $D\ f$, and from the points $f\ f$ draw lines parallel to $c\ l$, cutting the line $D\ D$ at $d\ d$, then the line $d\ d$ will be equal to the minor axis of the ellipse, or the smallest diameter of the bore of the cylinder, and $D\ D$ will, of course, be the major axis, or largest diameter.

The proportions of the ellipse may be measured directly from this diagram, or from it a formula may be derived, by which they can be computed.

The line $d\ f$ is the sine of the angle a, and the line from d to the center is the cosine; from which it follows, of course, that $d\ d$ is twice the cosine of a. Hence we have the formula,

$$d = D \times \text{cosine } a,$$

where d is the minor axis, or smallest diameter of the cylinder, D the major axis, or largest diameter, and a the angle between the bar and the center line of the cylinder or the lathe shears. If we have a bar with a fixed cutter, the point of which is say 10″ from the center line of the bar, we know that ordinarily it will bore a cylinder 20″ diameter. Suppose this bar to be set at an angle of 30° with the center line, and it is desired to know what the smallest diameter of the bore will be. D, the larger diameter, will, of course, be 20″, and this, multiplied by .866 (the cosine of 30°) = 17.32″, which is the smallest diameter of the cylinder.

Suppose that we use the same bar with the same cutter, set at the same distance from the center, and want to make the smallest diameter just 19″, while the larger diameter remains as before (20″). For such case we have the formula

$$\frac{d}{D} = \text{cosine } a.$$

Applying this formula to the case, 19″ ÷ 20″ = .95 = the cosine of 18° 11′, which is the angle to which the bar must be set.

Of course, in order to have the practical result agree closely with the figures, the cutter should be so shaped at the end that the middle of its cutting edge will be highest, and be ground back each side of the center to an angle with its side somewhat greater than the angle to which the bar is set. Theoretically, the point at which the two sides of the edge come together should be left sharp, though, of course, for all ordinary proportions or angles, it could be sufficiently rounded to make a practical tool, without affecting the accuracy of the results very much.

It so happens that Mr. Meyer's article on Practical Drawing for this week treats of the same principles as are involved in this matter of cylinder boring, and to those who desire to pursue the subject further, and become still more familiar with it, I would recommend a study of that article, remarking at the same time that this, like a great many other questions which sometimes puzzle machinists and others, would be quite easily understood, after acquiring a familiarity with the principles of mechanical drawing, though I have here tried to make this matter understood by those not familiar with that science.

Practical Drawing.

BY J. G. A. MEYER.

SIXTY-EIGHTH PAPER.

526. It has probably been noticed that, in finding the development shown in Fig. 419 (last paper), we have had no occasion to refer to Fig. 417. This figure is, of course, necessary to show us the form of the object or casing; but for laying out the sheet we only need a view—such as is shown in Fig. 416, with the auxiliary view shown in Fig. 416.1. But since Fig. 417 is required for showing us the form of the object or casing, it is necessary for us to draw the curves $c_2\ g_2\ c_4$ and $a_2\ e_2\ a_4$ correctly. These curves are not portions of a circumference of a circle, but each one is a semi-ellipse, and may be found in the following manner:

Through the points e, $2e$, $3e$, $4e$, g (Fig. 416), draw vertical lines, cutting the center line $e_2\ g_2$, Fig. 417, in the points e, $2e$, $3e$, $4e$ and g_2. Make $e\ e_2$ (Fig. 417) equal to $x\ l$ (Fig. 416.1); $2e\ 2w$ equal to $2x\ 2l$; $3e\ 3w$ equal to $3x\ 3l$; and $4e\ 4w$ equal to $4x\ 4l$; in a similar manner find the points c_4, $2y$, $3y$ and $4y$; the curve drawn through the points c_4, $2y$, g_2, $2w$, c_2, will be the required semi-ellipse; all the other curves in Fig. 417 are equal to one just found. We have described this method of finding the semi-ellipse very briefly, because this method is nothing else but an application of the principles given in Problem 73.

Directions. On one of 15″ × 20″ sheets draw a casing, as shown in Figs. 416, 417. Make $e\ g$ (Fig. 416) = 18 inches; $f\ h$ = 7 inches; $r\ s$ = 4½ inches; and the width $a_2\ a_4$ (Fig. 417) = 4¾ inches. Use scale of 6 inches to 1 foot. Then find developments as shown in Figs. 418, 419. After this draw the two views, Figs. 416, 417, in the space marked Problem 78 on the regular sheet, and find one-half of the development shown in Fig. 419. Use 3-inch scale.

Problem 79.

527. *To find the smallest cross-section of an oblique cylinder.*

Fig. 420, page 5, represents a vertical, and Fig. 421 a horizontal projection of an oblique cylinder. An oblique cylinder is one whose elements, as $a_1\ f_1$, $a_7\ f_7$ (Fig. 420) for instance, are not perpendicular to the bases $a_1\ a_7$, $f_1\ f_7$. The ellipse $b_1\ c_4\ b_7\ d_4$ in Fig. 421 represents the upper base, and since the line $a_1\ a_7$ (Fig. 420), which represents the same base, is parallel to the ground line $A\ B$, we know

that the true outline of this base is seen in Fig. 421. The two views given in Figs. 420, 421 show the form of the oblique cylinder, and if the dimensions had been given, we would then have a working drawing, which would convey to the workman all the information necessary for making the cylinder. Yet, with such a drawing before us, it may often be necessary, and sometimes advantageous, to know the smallest cross-section of such a cylinder, that is, a cross-section made by passing through the cylinder a plane perpendicular to its elements, or, as in the case before us, perpendicular to its axis. Hence we have the present problem of finding such a cross-section.

Let the line a_1 i in Fig. 420 represent a cutting plane perpendicular to the axis a_4 f_4; it is required to find the section made by passing this plane through the oblique cylinder. Prolong the elements a_1 f_1, a, f_7, and also the axis a_4 f_4 upwards. Anywhere above the base a_1 a_7, draw the line e_1 e_7 perpendicular to the axis and terminating in the prolonged elements a_1 f_1, a_7 f_7. Divide the line e_1 e_7 into any number of equal parts, say six; and through the points of division e_2, e_3, etc., draw lines parallel to the axis. Divide the major axis b_1 b_7 (Fig. 421) into the same number of equal parts as spaced off on the line e_1 e_7; through the points of division b_2, b_3, etc., draw vertical lines, cutting the circumference of the ellipse in the points c_2, d_2; c_3, d_3, etc. If these vertical lines, and also the lines through the points e_2, e_3, etc., parallel to the axis, have been correctly drawn, the base a_1 a_7 (Fig. 420) will pass through their intersections. Now make e_3 g_3 and e_2 h_2 (Fig. 420) each equal to b_3 c_3 (Fig. 421); $e_3 g_3$, $e_3 h_3$ each equal to b_3 c_3; and so on in succession, thereby obtaining the points g_3 h_2; g_3 h_3, etc.; a curve drawn through these points will be the outline of the required section. In the case before us it is found that this outline is the circumference of a circle described from the center e_4.

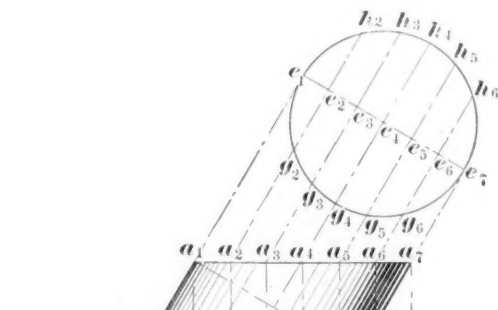


Fig. 420. Fig. 421.

528. Now, the student must not jump to the conclusion that the smallest cross-section of any oblique cylinder made by planes perpendicular to its elements will be a circle; such is not true. It happened to be so in this particular case; in fact, we have chosen this one, because cases of this kind present themselves frequently in practice.

529. Another particular case often met with in practice is shown in Figs. 422, 423. Here we have another oblique cylinder whose vertical projection is shown in Fig. 422, and its horizontal projection is shown in Fig. 423. In the latter figure, we notice that its bases are circles. The problem now is to find its smallest cross-section. We have already seen that the smallest cross-section is that one which is obtained by passing through the cylinder a plane perpendicular to the elements, or, in this case, perpendicular to the axis a_4 f_4. Let a_1 i represent this cutting plane. In finding this cross-section we follow the same mode of procedure as in the last case, namely, prolong upwards the elements a_1 f_1, a_7 f_7 (Fig. 422), and perpendicular to these draw the line e_1 e_7 anywhere above the base a_1 a_7. Divide e_1 e_7 into any number of equal parts, say six, and through the points of division e_2, e_3, etc., draw lines parallel to the elements. Divide the diameter b b_7 (Fig. 423) into the same number of parts as spaced off on the line e_1 e_7; and through the points of division b_2, b_3, etc., draw vertical lines, cutting the circumference of the circle in the points c_2, d_2; c_3, d_3, etc. Then make h_2 g_2 equal to c_2 d_2; h_3 g_3 equal to c_3 d_3, and so on in succession; a curve drawn through the points e_1 g_2, h_2, g_3, h_3, etc., will be the outline of the required cross-section, which in this case is an ellipse.

530. Comparing the cross-section in Fig. 420 with the one given in Fig. 422, we may say that the oblique cylinder shown in the former figure is simply a portion of a right cylinder with circular bases; and the oblique cylinder shown in the latter figure is simply a portion of a right cylinder with elliptical bases.

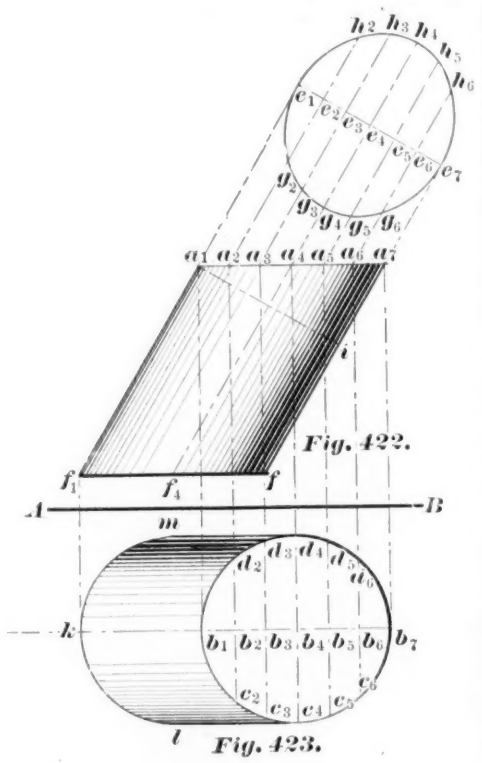


Fig. 422. Fig. 423.

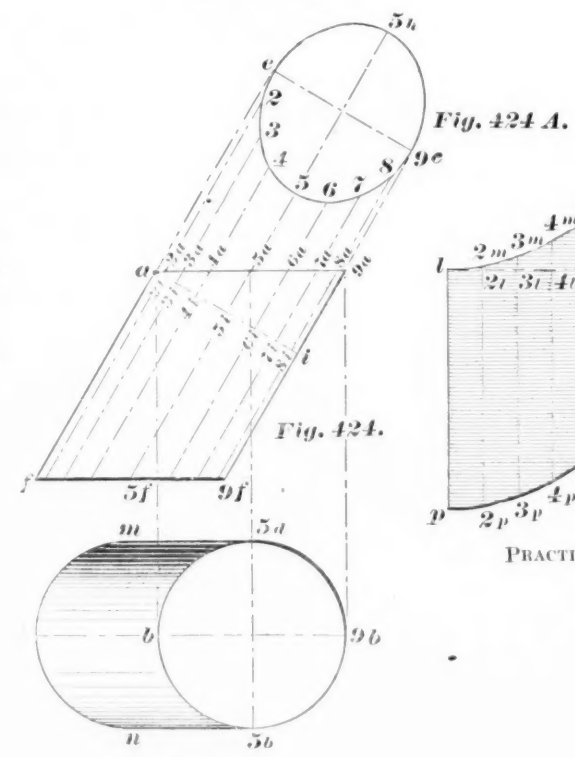


Fig. 424 A. Fig. 424. Fig. 425.

531. *To find the development of the cylindrical surface of any oblique cylinder.*

Let a 9a f 9f, Fig. 424, be the vertical, and k 5d 5b 9b, Fig. 425, the horizontal projection of an oblique cylinder; it is required to find the development of its cylindrical surface.

There are two methods for finding this development.

First method: First find the smallest cross-section of the cylinder; or, in other words, the section made by passing through the cylinder a cutting plane a i perpendicular to the axis 5a 5f, as explained in Art. 527. This section will be an ellipse e, 5 9e 5h, as shown in Fig. 424 A. Divide the circumference of one-half of this ellipse e, 5 9e into any number of equal parts, say eight, and through the points of division 2, 3, 4, etc., draw lines parallel to the center line 5h 5f, cutting the upper base a 9a in the points 2a, 3a, etc., and also cutting the line a i, drawn perpendicular to 5h 5f, through the point a, in the points 2i, 3i, etc.

Draw any horizontal line l m (Fig. 426), and make the length of this line equal to the circumference of the ellipse shown in Fig. 424 A.

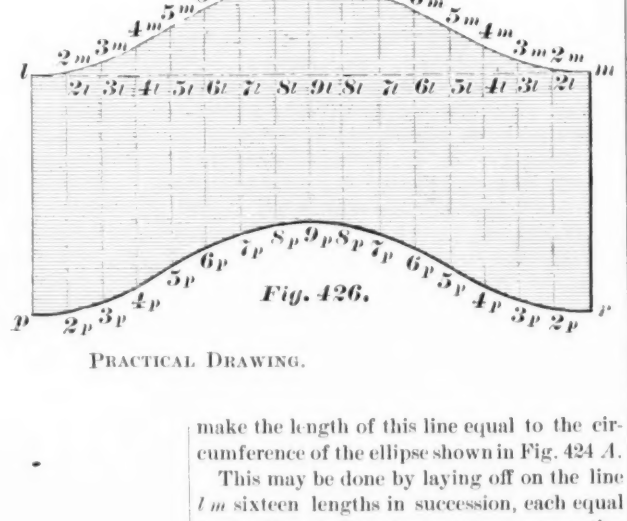


Fig. 426.

This may be done by laying off on the line l m sixteen lengths in succession, each equal to the distance between any two consecutive points previously laid off on the circumference of the ellipse; the sum of these lengths will be the length of the line l m, or we may say, the approximate development of the circumference of the ellipse. Through the points of division 2l, 3l, etc., which were obtained by laying off the short distances on the line l m, draw lines perpendicular to l m, and let them extend a little above it; also through the extremities l and m draw lines perpendicular to the line l m. On the line 2m 2p lay off a point 2m; the distance between the points 2l and 2m must be equal to 2i 2a (Fig. 424); in a similar manner make 3l 3m equal to 3i 3a; 4l 4m equal to 4i 4a, and so on in succession. Through the points l 2m, 3m, etc., draw a curve. Lastly, make each of the lines l p, 2m 2p, 3m 3p, etc., equal to a f (Fig. 424), and through their extremities draw the curve p 9p r. This completes the outline of the shaded part, which is the development of the cylindrical surface of the oblique cylinder shown in Fig. 424.

Comparing the construction shown in Figs. 413, 414, 415 (Art. 517), with the one before us, we find that they are similar, although in the former we found the development of a portion of a cylindrical surface, with cylindrical bases, and in the latter we found the development of a portion of a cylindrical surface, with elliptical bases.

Directions. In the space marked Prob. 80 draw the plan of an oblique cylinder, whose bases are circles 4 feet diameter; make the length from b to k (Fig. 425), equal to 2½ feet. From this view draw the elevation, making the length of a f (Fig. 424) equal 5 feet. Find the development of the cylindrical surface. Use a scale of ¼ inch to one foot.

LETTERS FROM PRACTICAL MEN.

Some Points on Boring Cylinders.

Editor American Machinist:

Some time ago, in your Answers to Correspondents, the question was asked:

If I bore a cylinder with the tail stock set over, will the hole be oval? (perhaps this is not worded just right, but that was the sense of it), and the answer was: Yes.

I called the attention of several of my friends to it, and we think different. If the answer is right, then it looks as if a taper pin turned by setting over the tail stock would be oval. I can see that the hole might be tapering, caused by the dead center not fitting and wearing loose.

If the cylinder is set true by the boring bar, and the boring bar runs true (concentric) on the centers, the cylinder will be round and practically straight from end to end, whether a fixed tool or sliding head is used. I have bored lots of cylinders, holding one end of the bar in the chuck and setting in for cut by throwing that end out of center; of course, it was a fixed tool bar. I never found that the holes were not true.

Now, Mr. Editor, I would like some light on a trouble I have found in boring cylinders on a lathe. The bar was 5″ round steel, about 5 feet long, driven by a face plate, to which it was fitted by a taper turned on one end; the other end ran on the tail center; the cutter was a piece of ¾″ square mushet steel, held by a key.

The cylinders would be tapering, being largest at the side that was done last.

The cylinders were fed towards the face plate, and they would always come large on the end towards the tail stock.

The cylinders were 10″ diameter, by 18″ long. W. O. PLATT.

[In another column will be found a full discussion of the effect of setting the lathe out of line when boring cylinders. As to the trouble mentioned above, we cannot say certainly what the cause may have been, but there is one point to be considered, *i. e.*, that a lathe, the centers of which are out of line either way, horizontally or vertically, will bore an elliptical hole when using a bar with a fixed cutter, and if, when boring on such a lathe, the cylinder be calipered at one end vertically and at the other end horizontally, one would naturally be led to think that the bore was taper. And it is a common thing to caliper in that way. This, however, is only a suggestion; but perhaps some of our readers may be able to point out the difficulty.]

The Gear Wheel Question.

Editor American Machinist:

In a late issue of the AMERICAN MACHINIST a writer states that one reason why gears cast from the pattern are not and cannot be as true as cut gears, is the uneven and excessive rapping of the gear pattern by the moulder.

No doubt there is much, and too much, rapping of patterns of all kinds by moulders. But gears will not stand the rapping that plain patterns will; for too liberal rapping of the patterns for a gear, especially if the pitch is fine or the face deep—if rapped sidewise too much, the sand teeth will be broken off, and when the pattern is withdrawn there will be more or less of the teeth

down, and then they are mended up, ofttimes with lifters and slickers, and sometimes with improvised teeth made by the helper and his pocket knife, and a piece of wooden soger. All three combined make *something*, and that something is generally not at all like the tooth required. But that is not making a gear; that is simply "getting there," as the saying is, after a very poor fashion.

In a shop where the writer once worked, gearing of every description was a specialty, and a poor gear pattern they did not have in or on their list. So particular were they, that when a new gear pattern was to be moulded, it was invariably given to the most experienced and careful gear moulder in the foundry, and, when rapped, it was done very gently, and only down, not sidewise. When drawn, if a tooth was imperfect, that tooth was marked and the pattern foreman remedied the derelict tooth or teeth.

Of all jobs that come to a moulder, the gear is generally loved best, and of all jobs there are none that require more judgment or greater skill to make right with the truest pattern. We refer to gears 12 inches and above in diameter, and from ½ to 1½ or 2 inches pitch, with face from 2 to 8, 10 or 12 inches or more. A gear to be made the nearest to truth should never be rolled over, if more than 12 inches in diameter, be it spur or beveled (if mortised with wooden teeth, of course, it does not matter). In turning over the drag or nowel, when rammed full of sand, with pattern enclosed, it is plain to see that there will be more or less settling, if the flask is of any size. The lower side must receive all the weight and compresses or springs, and when the drag is over and bottom board on the bed, does it or can it be made to bear equally at all points alike? It will be generally admitted that it don't; consequently those corners that bear lightest, if at all, settle away from the sand, and the sand, not to be left, settles away from the pattern, and that settling settles the question as to correctness of the resulting gear. When the moulder puts on the cope and rams it up, unless he exercises care and a fine sense of touch with his rammer, he can ram the sand in the drag away from the pattern, and destroy the truth of the mould the true pattern would have. If the flask is dilapidated, and the margin of sand around the pattern is narrow, the flask joint burnt, and perhaps open, the mould can be, and often is, warped and sometimes compressed, so that the casting is uneven in width of face, and the teeth just compressed enough to be enlarged without being crushed or misplaced. In the foundry before mentioned, if a large gear was to be made, requiring or having, for the sake of expediency, two moulders working on it, one of these two had to tuck up the teeth and ram the outside, and many a big red copper cent was tossed to settle the duties of the respective moulders. All gears in that shop above 12 inches diameter were bedded in, whether spur or bevel, and never allowed to be rolled over. With all the care before mentioned, and looking after many other things, such as strength of facing, temper of sand, swabbing, gating, etc., there yet remains that which is uncontrollable, *i. e.*, the *shrinkage of the metal*. And, as stated in a former article, the round pattern and round mould will not make a perfect round casting if you don't rap it at all. This is clearly and unmistakably shown in chilled car wheel making.

L. C. Jewett.

Day-Work or Piece-Work.

Editor American Machinist:

As a craftsman, I sympathize with "Day-Pay" in your issue of Dec. 20, on the subject of "Piece-Work *versus* Day-Work," but I cannot agree with him in regard to his resolution to never work piece-work again. I have worked in good shops and bad shops, shops that worked piece-work and shops that worked day-work, and have made up my mind to work piece-work as long as I can get it. It is the best equalizer of wages I ever saw. Why should I or any other machinist work for two dollars a day just because the man on the next planer or vise gets that?

I have worked as a journeyman in eight different shops, on different classes of work. Some of them were contract shops, where the work was given out to contractors who were held responsible for the work, and were allowed to select their help out of the shop men and boys, who had no earthly ambition more than to get their pay and spend it.

Under this system, the contractors made big money, but, alas, the lesser lights did not. Several years' experience in shops of this class, and a close study of the system, leads me to the conclusion that it is detrimental to both shop and workmen.

I once worked for a large concern employing some three hundred hands, all told. Their work was largely special machinery and patented specialties, on which there was not much competition. They wisely determined to adopt the piece-work system. At that time the machine shop was full of good, lively men; men, who were handy on the vise or machine—"Simon pure," as Chordal says. Some had worked at Bement's, some at Sellers', some at the Niles', some at Allis', and in fact, all sections were represented.

Well, when piece-work was started, some captured good jobs, and some did not, as the work was given out. Some quit, others staid, and as the time went on, they waxed rich in worldly goods, such as houses and lots. They put on lots of airs, were leaders in the little village society, sent their children to the academy, and some of them were elected councilmen from their wards.

But a change came. It was whispered that the bosses had determined to make a cut. On the first of the month following a notice was posted up, stating that fitters were to be reduced to a four dollar rate, machine hands to three. This was awful! My, how they kicked! I was one of them. I quit. No one had a string tied to me. The contractors swore they could not run their gangs, and pay journeymen's wages and live; they must have cheaper help. "Well, we will give you some boys," said the bosses. No, they wanted men, but would not pay two-fifty. Well, some of the single men quit. Work was good, and they could get work in the cities, where there were more attractions. So men were advertised for, and they came. Weren't they a bum lot, though! The different contractors, of course, had the say as to what wages were paid; wages were set at one-seventy-five and two dollars. Some stood it, and some quit. Then the festive boy got in his work. The contractors soon found out that a bright boy was worth two bum machinists, and he was cheaper too. This was lovely. The contractors were all making money again, and the good boys got a little extra money when the various jobs were finished.

The machine hands were careful not to make over their limit.

Some of the machines had to run nights on account of a rush. Jack tells his nightman to "go slow on that job"; the price is good, and he could make forty cents an hour; but if he did, he would get cut.

Now, what is the result? Work is delayed and the firm is behind in filling orders. If a new man comes to work, the old hands freeze him out, for fear he will get a contract and make more money than the limit, and then all will get cut again. No use talking, Mr. Editor, the men will beat the bosses every time.

What is the remedy for this state of affairs? Let me say right here, I have been on both sides of the question, and know what I am talking about. This is about the first of the new year, and is a tip-top time to try the remedy I am about to propose. You employers and shop owners who wish to increase your output the coming year, go out in the shop and say to your contractors and piece-workers, "The prices now in effect on all jobs will remain as now set for one year from date."

Then divide up your work, so that every man will have a chance to make money. Depend upon it, your work will come out faster and better. Then there will be some inducement for good men to come to your shop and stay. The foreman's labor will be lightened, and tool room expenses will come down. Everybody will feel good, and more white shirts will be worn in the shop, and that means clean men and clean work—not the kind of men who look at everything through the bottom of a beer glass.

In some future letter I will give my experience in a shop where no piece-work was allowed, and yet more work was done there than any shop I ever worked in.

Ex-Contractor.

Setting Tool for Turning Taper.

Editor American Machinist:

In turning tapers correctly, it is necessary that the tool should be set exactly on the center. To do this we must set the tool before placing the work in the lathe. But should the tool require grinding or changing before the work is finished, we are compelled to take the work out of the centers every time, in order to set the tool; for it cannot be set correctly by sight. This would be obviated if a center line were drawn along the mandrel of the tail-stock, say with a V-thread tool. To this line the tool may be set.

P. J. Kelly.

[Mr. Kelly sends a sketch which shows a line, drawn along the tail spindle for a short distance from the outer end, and level with the centers. There are numerous cases in which it is desirable to know just where the center line of a lathe is. For instance, it is necessary, in boring taper holes, either with the taper attachment or the compound rest, and usually, when doing this work, neither center is accessible, the live one being taken out and the other one impossible to bring up to the point of the tool. In chasing threads, the center line should also be referred to, and it is often impossible to get at the centers, especially when chasing internal threads. The idea of having a line somewhere, which is known to be just at the height of the centers, is a good one, but there are some points to be considered in choosing a place for that line. In most lathes the point of the ridiculously small screw, which is used to prevent rotary motion of the tail spindle, and the slot in which it works, soon wear, and permit the spindle to turn slightly. This would impair the accuracy of the line. On lathes having the carriage so constructed that, in adjusting the height of the tool, the cross slide is elevated to a greater or less angle, such a line would be of little use, because a tool set to it would be level with the centers only when at that distance from the center, and its height would be changed when moved either in or out. The first difficulty might be overcome by making the line on the tail block. But the only method I have found which is applicable to all cases, is to have a broad, flat, parallel strip, just long enough to reach across from one inside V to the other. This can be placed upon the top of these Vs where there is no wear, and can be brought up quite close to the cross slide on either side. Then an ordinary surface gauge can be placed upon it, having its needle set at the proper height. For greater convenience, the parallel strip may have a line drawn across it at such a distance from one end, that, when the strip is standing upon end upon a plane surface, the line will be at the proper height to set the gauge to. After trying quite a number of different plans, I like this best, chiefly because it is always applicable under any possible circumstances; though it is well to have a line drawn upon some part of the lathe, which can be referred to in many cases, without the necessity for setting the gauge.]

F. J. M.

Comparison of Steam and Gas Engines for Small and Steady Powers.

Editor American Machinist:

Mr. Harrop looks at the question from the point of view of the gas engine manufacturer, and, of course, he magnifies every point in favor of his favorite. My object is to get the power I require at the least cost, and I have no other interest in the matter.

Mr. Harrop puts the price of gasoline at seven cents per gallon, while it would cost me twice as much, in the quantities I should want and in position to use.

He says that it would require half of one man's time to attend to the steam engine. Anyone who has had anything to do with a small steam engine knows that it does not take one hour per day on an average. No mechanic would hire an engineer, or half an engineer, to run an eight-horse engine. The engineer of a hundred-horse engine is a man of leisure.

He says that $33.00 will pay for heating the shop when the gas engine is used. He would need his great coat and mittens in this climate, if his shop was larger than a horse car.

He does not seem to think it any trouble to lug coal and ashes for several stoves. In reality, the cost of taking care of the gas engine and the stoves is greater than the whole cost of taking care of the small steam engine and the steam heating apparatus.

And then the smell of gasoline. Whew!

The gas engine takes a stream of water, and I won't undertake to say which motor will take the most.

He says I am wrong as to the cost of the gas engine and as to the coal used by steam engine. I did not attempt to be right. I took those figures from the circulars of the manufacturers, and think one maker is quite as likely as the other to overrate the efficiency of his machine.

I will not deny the utility of the gas engine under some conditions. But for my purposes, to run an average of four horse-power steadily, and to heat a small shop, steam has the advantage two to one. Furthermore, I think that $1,100.00 for a gas engine, that cannot cost three hundred dollars to make, is a regular gouge.

George B. Grant.

Boston.

Condition and Prospects of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

Lodge, Davis & Co. (Iron and Brass Working Machinery), Cincinnati, Ohio, write us:

We are pleased to inform you that during the past year our business has been most satisfactory. Our sales have increased over those of last year, $148,000.00. We have added a new addition to our plant, 60 x 100, 3 stories, costing $25,000.00. Have stocked with improved machinery, and are running every department full. Our engine lathes, about which we wrote you last year, have obtained a wonderful popularity. We have steadily employed on this line 150 men, and have added to the sizes previously made, a 32″ and 38″, which we make in any lengths, from 12 to 24 feet. While the 32″ is an exact duplicate of our other lathes, as far as design is concerned, the 38″ is altered to the extent that we put power feed to the compound rest, instead of putting on the taper attachment, enabling user to bore or turn any angles with power feed, and, as all the gear for operating same are made of steel, and are of the most simple construction, so they can be handled very easily, this lathe is becoming as popular as the other sizes. Finding that many of our customers were desirous of buying our lathes, but did not want spindle with so large a hole through, and did not require taper attachment, we decided upon making a new line of lathes, in order to meet the wants of said customers. These are now ready, and we have put them on the market. They are selling very rapidly. While the compound rest and taper attachment are left off, these tools are fitted with the same care and attention that the regular line are, and are really a first-class tool at a reasonable figure. They are especially arranged so that they may be used in factories where large quantities of work of one kind are turned out.

We have added to our line of shapers a 15″ and 20″ crank shaper, made with special device for altering stroke while shaper is running, with the greatest nicety, both for the length and adjustment of the tool in its location, so that it may cut nearer to or farther from the column, as the operator may desire. These movements are made without stopping the machine.

We have added to our line of drill presses a manufacturer's lever drill press, and a 24″ and 28″ manufacturer's drill, which, while they are not fitted with all the elaborate improvements contained in our standard line, are suitable for customers who cannot pay so high a figure, but want a first-class tool suitable for their work, at a moderate price.

We have enlarged our tool room to double its former size, and inaugurated a new grinding room, which we have supplied with new and improved machinery for cylindrical grinding, and also a very large water emery wheel, for which we have a regular attendant, and to whom all the lathe, planer and shaper tools are brought to be ground. We have

found it a very profitable adjunct to our business. At one side of the same man is a twist drill grinder of the latest improved design, and all the drills in use are ground on this machine. Proper clearance and good cutting edges are thus assured for all work being done.

We have set apart a room especially for the repairing of all our machinery, so that it does not interfere with our manufacturing department. This we find also a profitable feature.

We have re-arranged our shops, so that all castings and raw materials, when received, are unloaded onto a 10-ton scale, and every pound weighed when received, and all finished product is shipped from the same door; this may also be weighed.

We have established agencies in Boston and San Francisco, making the parties interested with us, so that due attention shall be paid to the selling of our goods; and are about to start a branch house in Chicago, which shall be owned and run entirely by the home office.

We expect to increase our "ad." in the AMERICAN MACHINIST within the coming two months, to about four times its present dimensions, and will forward copy to you in due course of time.

This will no doubt be sufficient testimonial as to our experience of its value as an advertising medium.

We wish you the compliments of the season, and assure you, as far as we can see, 1889 is going to be a particularly good year, as we have received orders amounting to $15,000.00 the last day of the old and the second day of the new year.

Edward O. Chase (Light and Fine Machinery, Foot Lathes, Slide Rests and Lathe Fittings, Machinery and Dies for Hard Rubber Work), Newark, N. J., writes us:

For the past few years my business has been mainly in the designing and building of special machinery—rubber-moulds and dies, comb-sawing machines, etc., etc.—and, with the exception of the three months last past, when politics interfered with plans for new work, the results of the year have been good, and quite satisfactory, under the circumstances. On the whole, I consider that 1888 has been, for a "presidential" year, an exceptionally good one, and the orders which greeted us with the opening of 1889 bid fair to make it a much more busy and profitable one than the last, if the general feeling of confidence and hopefulness already displayed, is any indication for the future months. Prices and wages, as a rule, remain about the same as a year ago.

Gage Machine Works (Machinists' Tools, etc.), Waterford, N. Y., write us:

Our business has been somewhat slow during the past summer and fall, but is now quite brisk; are working entirely on orders, with many inquiries and good prospects.

I. P. Richards (Standard Punches and Dies), Providence, R. I., writes us:

Business has been good the past year. I have introduced my "New" standard punches into a number of shops, and I expect to see them generally adopted by all who are punching iron and steel, as fast as they can see the convenience and economy in using these tools.

My new reduced price list is now ready, with prices so low that it will not pay for parties to make their own punches and dies.

The Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn., write us:

The business of this company for 1888 has steadily increased each month, and the business for the year is largely in excess of any previous year. It now requires a corps of 95 inspectors to properly examine and care for the large number of boilers under our supervision. The outlook for the new year is encouraging.

The Mason Regulator Co. (Pressure Regulators, etc.), write us:

Our business for the past year has exceeded our expectations, especially that with the railroads. Our locomotive reducing valve has been adopted by the steam car-heating companies to such an extent that, during the latter part of the year, we have been obliged to run nights. Our general trade in the other steam regulating specialties manufactured by us has also increased. We look for a still further increase in business during 1889.

The Nicholson File Company, Providence, R. I., write us:

The volume of our business during the past year is fully up to the preceding year; prices, however, are very low—in fact, too low, we think, to continue.

In an off year like the past, the evil tendencies of the middleman to force the sale of the lower price goods at the expense of brands well established, because of their ability to obtain a larger profit for the time being, works to the immediate disadvantage of both the manufacturer of such brands and consumer, compelling them frequently to seek each other, oftentimes against their wishes, and in the long run, working an injury to the middleman, who, to a reasonable extent, should be supported.

We have added several improvements and special devices to our plant during the past year, and expect to add still further during the coming year, to keep pace with the growing demand for our goods.

Our X F of Swiss pattern files are fast replacing the foreign makes, many of the best manufacturers in our country using them exclusively.

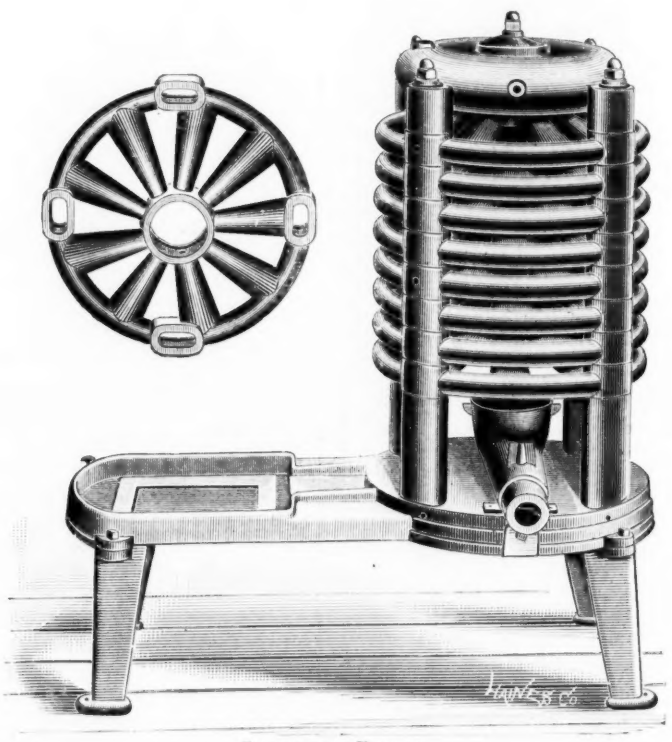
We look for a good, healthy business during the coming year, and trust a boom will not reach us—we do not like them.

Detrick & Harvey (Open-Side Iron Planers, Special Machinery, etc.), Baltimore, Md., write us:

The past year has been a very satisfactory one with us, possibly due to the fact that our product is becoming better known.

We have added some new and improved tools, which, together with increased room and force, have benefited us in the cheaper and quicker production of our work.

We have reason to believe that the ensuing year will be as satisfactory as the past. The present outlook would seem to predict an improvement.



SECTIONAL BOILER.

The Hall Steam Pump Company write us:

The past year has been one that has shown a steady growth in our business. We have been pushed beyond our manufacturing facilities, and are obliged to run shops overtime.

It is most satisfactory to us to have such substantial evidence of the appreciation of the Hall Duplex steam pump, and our make of power pumping machinery.

The outlook for 1889 is very encouraging for us.

Sebastian, May & Co. (Foot and Power Lathes, Drill Presses, Chucks, Drills, Machinists' and Amateurs' Supplies), Cincinnati, Ohio, write us:

The past year, or rather the first nine months, was all that could be expected of it; during that time we did a very satisfactory business, and received good prices for our tools. During the last three months of the year business was not so good, but the present year has opened very satisfactorily, and we confidently expect a very large and increasing trade; in fact, we think it will be the best year we have yet experienced, as we have our business well established and our tools have a high reputation, which we shall maintain.

We are preparing to increase our plant and capital, but can say but little about that until our arrangements are more complete; we are also preparing drawings for some new tools, which we will bring out during the coming year. While we feel flattered with our past success, yet we think we shall be more than pleased with our future business.

The Gage Tool Company (Self-Setting Bench Planes), Vineland, N. J., write us:

We have increased our facilities for manufacturing our bench planes, and our market is widening, taking in several foreign countries. We claim that our planes are the best in the world, and it is conceded by all who use them.

The self-setting arrangement gives great satisfaction; no trouble to set the plane. Amateurs and inexperienced persons can use it, and the mechanic saves time and lightens labor. We have secured such a uniformity in the tempering of our steel-cutting irons, that we give the broadest guarantee of satisfaction to the user on any kind of wood, however hard, knotty, cross-grained or resinous.

We are sending sample planes on receipt of price to any part of the United States or Mexico, with the privilege of returning them at any time within thirty days, we paying all charges and returning all the money paid, if they are not perfectly satisfactory.

During the year we have sent planes to Great Britain and some of her most distant colonies; also to Germany, and, notwithstanding the heavy duty, we have sent some to Canada.

We have also sold a number to educational institutions where manual training is introduced. The professors and teachers are well pleased with them, and have given us the most unqualified testimonials, preferring them to all others, whether wood or iron. Taking into consideration the above facts, and the universal satisfaction given by our planes, our prospects for the current year are good.

The Harrison Safety Boiler Works, Germantown Junction, Philadelphia, Pa., write us:

Our business during 1888 has been unusually steady, and, from present prospects, we confidently expect a still further increase this year; we now have a number of orders on our books for boilers to be delivered in the spring, as soon as the weather permits building operations to be carried on.

The most important enlargement of plant made last year was our new office building, which was described in your issue of December 20th.

Prices of labor and raw material are about the same as a year ago.

The demand for the Cochrane patent feed-water heater and purifier, manufactured by us, has also increased rapidly; among those built last year was one of 1,500 horse-power capacity for Messrs. Cheney Brothers at South Manchester, Conn., and we have also just shipped a large one to Mexico.

Sectional Boiler for Burning Oil or Gas.

The engraving shows the construction of an improved sectional boiler, designed for the use of oil or gas as fuel, and used with the Acme Automatic Safety Engines, built by the Rochester Machine Tool Works, Rochester, N. Y.

The jackets are removed to show the internal arrangement, and a separate view of one of the sections is also given. The boiler is constructed by placing these sections one on top of another, and passing long bolts through the four slots, the arrangement being such that the gases, in passing through between the radial tubes of one section, strike directly upon those of the next higher section. These tubes are inclined in such a way as to secure a rapid and thorough circulation, increased in its rapidity by the intensity of the fire. A large ring at the top of the boiler affords an ample supply of dry steam, while all sediment is deposited in the water space below the fire, where it can be readily blown out or removed, when the boiler is cold. The boiler is double-jacketed, to prevent, so far as possible, loss of heat by radiation. It is claimed that this boiler cannot be disastrously exploded.

The water supply is maintained by a pump worked directly from the main shaft, which forces the water through a coil heater, where it is subjected to the effect of the exhaust steam, before entering the water leg of the boiler; by this means the feed water is heated to near or above the boiling point before entering the boiler, without in the least choking the exhaust, or being contaminated with the cylinder oil or other deleterious substances.

The supply of water to feed pump is regulated by a ball float in a case attached to the boiler, which, by means of levers, controls the amount delivered at each revolution of the engine, and may be adjusted to maintain the level of water in boiler desired, under all the varying loads to which engine may be subjected.

This boiler has shown excellent economy in the use of natural gas, as the requirements for the utilization of the heat are the same as with oil, for which the boiler was originally designed. With either fuel, no forced draft is to be used.

One instance is cited in which a boiler, which had given good results with hard coal as fuel, was supplied with gas and used 5,000 ft. per day. One of these boilers, put in to replace it, and doing the same work, consumed 1,000 ft.

A railroad club has been formed at St. Paul, Minn., and we feel certain that the men who help to carry it on, and the railroads they belong to, will be materially benefited by the information gained by attending the meetings. In the account of the preliminary meeting called to form the club it might be noticed that the chief mechanical officers of one or two of the neighboring roads, with headquarters in one of the Twin cities, were conspicuous by their absence. Keeping away from meetings of this kind is short-sighted policy, and it is a sure sign that the parties concerned are not anxious to keep abreast of current progress in railroad machinery matters. The same thing is to be found in other places where railroad clubs meet, and with few exceptions the men who keep aloof from the clubs run their departments in a manner that is no credit to themselves or the roads they are connected with. —*National Car and Locomotive Builder.*

His Eagle Eye Was Closed.

For enginemen to fall asleep when upon the road and in motion has long been recognized as a dangerous practice, and one calculated to be fraught with unpleasant consequences; but the following incident shows that it may also be dangerous to sleep upon an engine, even when within the charmed circle of the roundhouse.

A negro fireman, while asleep on his engine in the roundhouse of the Louisville & Nashville Railroad at Birmingham, dreamed that he had received a signal to back out, and pulled the lever, blew the whistle, rang the bell, and backed the engine into the turntable pit. The jar occasioned by the fall of the engine into the pit awakened him, and he immediately took to the woods. The engine was not damaged, but it took a good deal of time and trouble to get it out of the hole.—*Columbus Inquirer.*

Passing a hardware store, I saw something that may give a useful hint to some retailer. I saw a man affixing labels to bright tin boxes, and, investigating the process, found each tin was well scrubbed with a hot, strong solution of washing soda, the surface was then rubbed with a raw onion (or onion juice), and the label pasted and fixed in the usual way. It is said to be almost impossible to separate paper and metal so joined.—*Tobacco.*

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J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

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Conservatism Now and Then.

One would suppose that the evil effects of the fact that Galileo was made to suffer for his announcement of some of the wonderful discoveries which he had made, and for declaring truths which are now universally recognized, had long since passed away, and that, however discouraging to the early pioneers in steam navigation may have been the prophecy of some of the knowing ones, that no vessel could be constructed which would carry sufficient coal to propel itself across the ocean, the impediments to progress caused by that prophecy had been entirely removed by the complete success of steam navigation. The fact seems to be, however, that the struggles and hardships which the inventors and leaders of thought were compelled to undergo in former days are having an influence in our times, and that influence is often made to help the charlatan in his schemes to deceive the public and reap a golden harvest from those who seemingly are ever on the alert for chances to invest money in some device for cheating nature into a departure from her own laws. And, of course, every such scheme into which men put their money, and lose it, makes it more difficult for one who has a really meritorious invention, to get recognition and the financial aid necessary for bringing his invention before the public.

No sooner is the scheme of some hare-brained individual or deliberate fraud condemned by practical men who have made a study of the principles involved, than we are reminded that all great inventors have had their inventions condemned by those who professed to be especially well informed in the department of science to which the inventions related, and that the merit and importance of a new discovery has always been in direct proportion to the amount of opposition brought to bear against it. The man who has money which he is anxious to invest in a way to bring large returns, is told that the objections which have been brought against the latest scheme of some visionary or fraud by mechanics, engineers and scientists, furnish only another illustration of the familiar fact that all really great inventions and discoveries have to pass through that stage of existence, in which the united opposition of the slow-going, conservative and unprogressive must be encountered and overcome. In proof of which, history is appealed to, and usually with good effect. There can be no doubt that Keely has been greatly helped by the records of history regarding such matters, and the greatest harm done by Keely is not that he has induced certain men to invest money in a thing which possesses no value whatever, but that, by doing this, he has made it more difficult for actual inventors to get their just dues. There is an important difference in the nature of the opposition which was brought against new discoveries in the time of Galileo and that which is brought against unpractical and absurd schemes in our day, which is apt to be overlooked. In those days the church claimed a monopoly of all knowledge, and opposition to new ideas arose from the fact that they were supposed to conflict with her tenets and interfere with her authority over the affairs of men and of nations. The opposition to the many wild and visionary schemes of to-day is usually founded upon and arises from an entirely different cause, viz., that they run counter to well known, thoroughly tested and firmly established physical laws. The development of science has not only shown many things to be practicable which were formerly considered impossible, but it has also proven many things to be impossible, which, with less knowledge of natural law, might be, and, indeed, were formerly considered quite attainable.

To Galileo himself belongs much of the credit for the discovery of natural laws and for the establishment of the science of mechanics, by which the claims of the Keelys of to-day are measured and their value determined. Keely has been compared to him, because they were both thrown into prison, but, in fact, this is the only point of resemblance between them. Galileo suffered for telling truths, and demonstrating the correctness of his position, while Keely was put in jail for refusing to tell anything which it is all-desirable to know, and for refusing any demonstration.

To Galileo probably more than to any other man are we indebted for our understanding of the laws by which we are enabled to know that the claims made by Keely can never be fulfilled. These are not the laws of man or of an ecclesiastical body, but of nature; self-creating, self-operating, unchangeable and unavoidable.

Steam Valves.

A correspondent, whose name would be generally recognized if published, sends us the following:

Why don't some one put on the market a valve that will hold steam?

A valve that will hold steam absolutely without leak, and do it for any length of time when in daily use, is something about as hard to make as anything that can be imagined. Still we believe that valves that can be depended upon to do this within reasonable limits can be had by paying for them. Ninety-nine out of one hundred of those who buy valves buy those that are the cheapest. And manufacturers may be depended upon to meet this demand. When a man buys a steam valve for less than what he knows the metal in such a valve ought to cost, he ought not to expect to get a good one.

Our correspondent does not want to do this, but he is, we are sure, the victim of those who do want to. The work of educating steam users up to buying a really good valve, is a work so large in its proportions that we have no condemnation for manufacturers who do not hanker after the job. A manufacturer must make what will sell, and those who have tried to put really good valves on the market have not had an enviable experience.

A correspondent of the *Commercial Advertiser*, who conceals his identity, writes sensibly in regard to the utility of the great public libraries of New York. He takes the same view that has often been taken by the AMERICAN MACHINIST, viz., that the hours during which such libraries are open, are those in which busy men cannot consult them, and hence, that such libraries are—so far as their intended purposes—just about as useful as the fifth wheel of a cart. If some benevolent New Yorker, who desires to establish a great public library, would add a little common sense to his benevolent intentions, he might possibly learn that the men who would really be benefited by his benevolence—those whose means would not permit them to own a large library of their own—have no time that is their own between the hours of nine and four, in the day-time. The most useful purpose our great libraries serve, is to provide something to talk about. It is a pity this is so, but it is so just the same.

Meeting of the Mining Engineers.

The fifty-third meeting of the Institute of Mining Engineers will be held in New York city, beginning Tuesday evening, Feb. 19. Headquarters will be at Union Square Hotel. It is expected this will be one of the largest and most interesting meetings ever held.

Literary Notes.

We have received the *Twenty-fourth Annual Catalogue* (1888-1889) of the Massachusetts Institute of Technology. It contains a list of the officers and students, with a statement of the courses of instruction; also a list of the alumni. The catalogue shows the Institute to be in a flourishing condition, and gives a good idea of the thorough courses pursued.

The holiday number of the *Northwestern Miller* is a gorgeous affair, in a cream-colored cover. Inside is a large amount of matter, interesting to millers and others, besides several poems, illustrated, and stories, also illustrated, in prose, all by popular writers. The price of this number is 50 cents.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(22) T. J., Johnstown, ——, asks: What is the cost of taking out a patent on a small tool? *A.*—If only one sheet of drawings is required, it will cost you, attorney's fees included, about $65.00.

(23) F. C. W., Rochester, N. Y., asks: At what point in the stroke does the exhaust valve of a Corliss engine open and close? *A.*—There is no rule for this. Probably at 15-16 of the stroke would be a fair average.

(24) H. M., Philadelphia, Pa., asks: In what direction does a stationary engine run when it runs *forward*? *A.*—Stand at the cylinder, and look towards the fly-wheel. If the top of the wheel revolves in a direction away from you, then the engine runs forward, or over.

(25) J. P. G., Columbus, Ga., asks: Do you know of any piston packing that will not leak hot oil or steam, with 140 pounds' steam pressure on one side, and hot oil on the other side? The piston travels very slow. *A.*—As, under the conditions, you must use metallic packing, we do not know of any that will be absolutely tight.

(26) R. M., ——, N. C., asks: What would be the horse-power of an engine 14"x24", at 90 revolutions per minute, boiler pressure, 70 pounds? The engine has plain slide valve, with ½ inch lap. *A.*—Giving the lap of valve without dimensions of ports and valve travel is of no use. If the engine is well constructed and piped, it ought to develop 58 indicated horse-power, leaving a reasonable margin for governing.

(27) J. C. K., Brooklyn, N. Y., asks: Will you kindly give me the title and where I can purchase a book giving full details of a locomotive in regards to its construction and operation? *A.*—Catechism of the Locomotive, by M. N. Forney; Locomotive Engine Running and Management, by Angus Sinclair. These books you can obtain from any dealer in scientific books. The articles on Modern Locomotive Construction, now running in the AMERICAN MACHINIST, will be made as complete as possible.

(28) "Niagara," Lockport, N. Y. writes: Suppose I have a spiral spring 5 inches long, which, by placing upon it a weight of 30 pounds, will be compressed 1 inch. Now, if I attach the end of this spring to a piston of just one square inch area, and with a pressure upon it of 30 pounds, will the spring be again compressed one inch? *A.*—Yes, if we do not consider the friction of the piston. 2. If I apply the same spring to a piston, the area of which is just one-half of one square inch, with the same pressure per inch, do I get the same results? *A.*—Certainly not. You will get only half the total pressure upon the piston, and the spring under ordinary conditions will be compressed just half as much, or one-half inch.

(29) Subscriber, Auburn, N. Y., writes: I notice in your paper that you mention "Haswell's" as authority on steam engine subjects. Could you give me an idea as to what the book embraces? Also, do you sell it? *A.*—We do not sell any books. "Haswell's" is simply an Engineers' and Mechanics' Pocket Book, containing weights, measures, mensuration, trigonometry, hydraulics, strength of material, steam engineering, etc. It is a book of reference, and not a text book. 2. What would be the force of a blow of steam issuing from a 6-inch pipe connected with two 80 horse-power boilers at 50 pounds gauge pressure striking a brick wall 15 feet from end of pipe? The pipe is opened instantly, as by breaking of an elbow. *A.*—We have no experimental data, and we believe there is none, upon which we can base our calculation. It seems to us that you can obtain this information only by actual experiments.

(30) J. C. H., Cincinnati, Ohio, asks: How far will one of the large ocean steamships travel before stopping, if her engines are reversed while the vessel is running at full speed? *A.*—The distance will vary considerably for the different vessels. There are so many conditions which will have an influence on this distance, and it will also vary for each particular ship. Some steamships may be stopped within a distance of one mile, others may travel considerably further. 2. Where can I find an account of what has been done or suggested to lessen the chance of collision at sea? *A.*—In regard to this there are some instructions given in the General Rules and Regulations prescribed by the Board of Supervising Inspectors of Steam Vessels. A marine brake has also been suggested; and other modes for lessening the chances of collision at sea have been published from time to

time in the daily papers, of which we have not kept a record. 3. Where can I find an account of the most remarkable of such collisions? *A.*—Some of the monthly magazines keep a record of such accidents.

(31) Theo., ———, writes, enclosing a small piece of steel, which is in the form of a segment of a circle, and asks for the best and cheapest method of grinding and polishing the inside surface of such pieces in large quantities. *A.*—This is a special operation, which will require the use of special fixtures. These fixtures must be designed by some one thoroughly familiar with all the conditions and requirements of the case. For obvious reasons, we cannot undertake such work in this column. He also asks: 1. If I want to use leather-covered buffs instead of wooden ones, can the leather-covered ones stand to be used with oil? *A.*—We do not think you can use such wheels with oil. 2. One trouble with the wooden buffs is that they soon wear, so that the diameter becomes too small to grind the whole surface. Do you think buffs of babbitt metal will give good results? *A.*—We have never used babbitt for such a purpose. It is an easy matter to make a trial of it. Lead is often used. 3. How many revolutions per minute is proper for this kind of buffs when the diameter is 1½ inches? *A.*—The faster they are run the better, within the safe limit of the strength of the material of which they are made. To be effective, they should run not less than 2,500 to 3,000 revolutions per minute. 4. I am troubled with the governor belt on a Baxter engine. It is a common belt, ¾″ wide, but it don't last very long, on account of the heat, and because, also, it gets soaked with oil. Is there any kind of belt in the market which will answer the purpose better? *A.*—You do not state what kind of a belt you are using, but we do not know of any kind of belting which will work well when soaked with oil and kept hot.

(32) T. P. A., ———, writes: I have had a great deal of trouble with my engine, and wish to make it stronger. It is 30 inches bore, 42 inches stroke, horizontal type. The piston will slip on the rod; the former is simply shrunk on the rod without a shoulder. The piston rod is 4⅛ inches diameter; depth of piston, 6 inches. We use 85 pounds' steam pressure in boiler, and sometimes that hardly keeps up the speed, which is 83 revolutions per minute. Can I use any better plan to secure the piston and still use the same rod and cylinder head? *A.*—The piston rod is large enough to turn the piston end down so as to form a shoulder of ⅛-inch on the rod; make a tapered piston fit, and key the piston to the rod. If the piston at present in use is a solid one, you will need a new piston; if it is a spider with follower, similar in design to locomotive piston, as illustrated in our issue of June 11, 1887, and if there is stock enough in the center, you may drive in a tapered bushing with a tapered hole to fit the rod. 2. The next weakest point is the crosshead, which is simply tapped 6 inches deep, 4 threads to the inch, to fit the rod jam nut to lock it. Do you consider this way of securing it as good as a taper fit with a key, which would require a new crosshead? *A.*—We believe that in your case the best way will be to key the crosshead to the piston rod, the latter having a tapered fit. It may not be necessary to throw away the crosshead at present in use. If the design of crosshead will permit, drive in a tapered bushing, as recommended for the piston, and key the whole to the end of piston rod. 3. Please give me a rough estimate of the horse-power of our engine, 30x42 inches, 83 revolutions, 85 pounds' boiler pressure; cut-off at ¾ stroke; steam ports 2⅛x21 inches; Water's governor. *A.*—We assume your engine to be non-condensing. For your piston speed the steam ports are too small; you will always have some difficulty to keep up the required speed. If the steam ports had been large enough, we should rate your engine at about 480 horse-power.

(33) A. E. L., Peterborough, Canada, writes: Inclosed we hand you a sketch of a steam heating boiler which the writer had put into his house. This boiler does not work satisfactorily; I will explain its action as near as I possibly can. In the first place, it heats the house fairly well in mild weather, but the steam gauge shows no pressure, although it is in good working order. The boiler has been set up about ten days, and is apparently as dry as it can be, although it is not warm to the touch on the outside. The boiler sets on a cast-iron base, the fire-box sheet rests on the cast base; the outer shell and tubes overhang. The gases pass upwards towards the crown sheet, then downwards through the flues, and finally, upwards around the outside of the boiler, and led into the chimney. The size of chimney is 9x11 inches; it is straight and has a good draft. The boiler has to supply radiators and coils, etc., equal to about 1,200 lineal feet of 1-inch pipe. We have thought perhaps it had too much draft, and have opened the check draft door near the chimney, but to no good; we tried it with the damper shut, but still no use. With the damper shut it still burnt up the coal, and nearly as much as when the draft was turned on. We have looked very carefully for leaks, but apparently there were none. Now, we have thought, that perhaps there is too much air space between the grate bars; the spaces are 1⅛ inch wide, and contain 287 square inches; the area of chimney is 99 square inches, and the area of tubes 83 square inches. But here is the strangest part of it: another boiler of the same size in this place supplies from one-quarter to one-half more piping than ours, and it keeps up a constant steam pressure of two pounds, and by opening the damper they can get up the pressure to wherever they want it. Could you kindly give us an idea as to what is wrong with our boiler? *A.*—If your sketch is correct, the trouble lies in the arrangement of the ash pan. Your sketch represents a number of tubes to be in communication with the ash pan, so that these tubes will lead air into the furnace; and besides this evil, a large amount of air entering the ash pan will enter direct into the space around the boiler and its brickwork, where it will be heated, and thus carry off through the chimney a large amount of heat, which otherwise would have been used for warming the building. From this it will be seen that only a few tubes are left to do that duty for which all the tubes were designed, namely, to lead the products of combustion from the furnace into the space around the boiler, and from thence into the chimney. By changing the arrangement of the ash pan, you will remove the cause of the trouble, and we believe the boiler will then work satisfactorily.

(34) B. S., Chicago, Ill., writes: Will you please answer the following question? I wish to find some formula or table for the flow of water through pipes. For example, I have a cylinder in the basement of a building; in that cylinder is a piston which I want to move at a given speed per minute; on the roof of the building is a tank which is connected to the cylinder by a pipe. Now, I desire some table or rule whereby I can calculate the proper sizes of that pipe, so that the same pressure will be maintained on the piston throughout the stroke. In order to give you an idea of the way most of my piping is put up, I enclose a sketch of the same. *A.*—In the first place find the velocity of the discharge through the pipes. This is found by the rule given in answer to Question 281, in our issue of June 2, 1888. The rule expressed in symbols is as follows:

$$v = 8\sqrt{h}$$

in which v = velocity in feet per second, and h = head in feet. For your work the head will be equal to the vertical distance measured from the center of the entrance of the pipe into the cylinder to the water level in the tank. If, for instance, the vertical distance is 81 feet, then the velocity of the discharge will be equal to $8 \times \sqrt{81} = 72$ feet per second. The quantity of water discharged per second through the pipe will be equal to the product of the cross-sectional area in square feet of the pipe multiplied by the velocity in feet per second. Or if we allow Q to represent the quantity of cubic feet of water discharged per second, and a the area in square feet of the inner cross-section of the pipe, then the foregoing rule can be expressed in symbols, thus:

$$Q = v\,a.$$

From this we obtain the formula

$$\frac{Q}{v} = a.$$

That is to say, when we know the quantity of water to be discharged per second, and also the velocity of the discharge, we simply divide the quantity by the velocity; the quotient will be the inner cross-sectional area of the pipe, the unit of measurement being the same as stated. Here friction has not been taken into account; but for this we shall make a certain allowance, as we shall presently show. In order to keep up the pressure behind the piston, the quantity discharged through the pipes must be equal to the displacement per second of the piston, and this displacement is equal to the product of the area of the piston multiplied by the stroke and number of strokes per second. Hence, to find the area of the pipe we have simply to divide this displacement of cubic feet in one second, by the velocity of the discharge of the pipe; the quotient will be the area of the pipe in square feet. This rule can be made simpler and stated in the following manner: Let A represent the area in square inches of the piston, V the velocity of the piston in feet per second, v the velocity of the discharge of the pipe in feet per second, and a the area of the pipe in inches; then

$$a = \frac{A \times V}{v}$$

For example, let the velocity of the discharge through the pipe be 72 feet per second; diameter of cylinder, 6 inches; stroke, 4 feet; number of strokes per second, 1; find the area of the pipe which shall maintain a constant pressure on the piston. Here the velocity of the piston per second is evidently 4 feet; the area of the piston is 28.27 square inches. Hence

$$\frac{28.27 \times 4}{72} = 1.5+$$ square inches in the cross-sectional area of the pipe. To allow for friction, obstruction, etc., add 20 per cent.; this will make the area of the pipe equal to 1.8 square inches. From the table of areas given in any Engineer's Pocket Book we find that the diameter of such a pipe should be very nearly equal to 1 9-16 inch.

On your sketch we notice that you have a reducing valve. In this case we must first find the head due to the reduced pressure. This head is found by dividing the reduced pressure by .434. Thus let the reduced pressure be equal to 10 pounds, then the head will be equal to $\frac{10}{.434} = 23$ feet; the small fraction is here neglected. This head must be added to the vertical distance from the center of opening in the cylinder to the reducing valve; and then we must determine the velocity of the discharge due to the total head by the rule previously given. When this velocity is known we proceed as before, thus: Let the distance from the cylinder to the reducing valve be 13 feet; reduced pressure, 10 pounds; cylinder, 6 inches diameter; stroke, 4 feet; number of strokes per second, 1; find the diameter of the pipe. The head due to the pressure of 10 pounds we have found to be 23 feet; 23 + 13 = 36 feet, which is the total head; velocity due to the total head of 36 feet is equal to $8 \times \sqrt{36} = 48$ feet per second. Area of pipe will be equal to

$$\frac{28.27 \times 4}{48} = 2.35$$ square inches. Adding 20 per cent. we have 2.82 square inches, and the diameter will be 1 15-16 inch.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p. 16.

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See illustration of improvements in Hooks for Steam Engines, in Nov. 24 issue. For particulars address T. C. Dill Machine Co., 726 Girard av., Phila., Pa.

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"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including Jan. 3, 1889 issue, 67 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 82 articles have thus far appeared up to and including the Jan. 10, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

A. M. Wetherbee contemplates starting a machine shop at West Point, Miss.

The Selma (Ala.) Saw Mill and Manufacturing Co. has been organized.

The Chattanooga (Tenn.) Foundry & Pipe Co. propose an enlargement of their works.

A woolen mill will be built at Millville, Mass., on the site of the one burned down last spring.

The Georgia Pacific Railroad Co. are building a wood-working shop 60x175 feet at Birmingham, Ala.

The Birmingham (Ala.) Mining & Manufacturing Co. will build furnaces and iron and steel works at Gate City, Ala.

The W. T. Pine Mill and Supply Co. has been incorporated, to manufacture and sell machinery, at Louisville, Ky.

Perkins & Co., Grand Rapids, Mich., are building an addition to their machine shop, 75x90 feet, and three stories high.

The Novelty Steel Wheel Manufacturing Company, of Pittsburgh, Pa., has decided to build shops near McKeesport, Pa.

The old Brownsville Woolen Mill, at Brownsville, Ore., will be refitted and put in operation by the Brownsville Woolen Manufacturing Company.

C. H. Chalmers has come into possession of a mill property at Brownsfield, Maine, and started in the manufacture of various articles of woodenware.

The Mason Regulator Co., of Boston, have just received from the committee of the Scandinavian Exhibition, recently held in Copenhagen, a diploma of excellence for their reducing valves.

There is water-works agitation at Pulaski, Tenn.; Roanoke, Va.; Hawley, Pa.; Marlison, Neb.; Grinnell, Iowa; Milford, N. H.; Deckertown, N. J.; Marion, Ohio; Woodstown, N. J.; Great Falls, Mont.; Seattle, W. T.

It is reported that the Acme Manufacturing Company, of Wilmington, Miss., have sold out to northern capitalists, who will invest several million dollars in building pine straw bagging mills at different points in the South.

The Taunton (Mass.) Locomotive Works has come under new management, and the intention is to add improved machinery and put up new buildings, putting the shops on a basis for competition with other locomotive shops.

The old Matchett factory at Pittsburgh, Pa., is being refitted by the Matchett Paper Box Co. Not less than $30,000 worth of new machinery, and employment given 150 hands. It will be the largest factory of the kind west of Philadelphia.

The Iron City Manufacturing Company is the name of a new company to manufacture iron and steel at Pittsburgh, Pa. The directors are: Frank L. Blair, Joseph M. Porter, William H. Pfohl, Richard D. Porter and Wm. D. Porter. Robert J. Taggart is treasurer.

A new saw mill is to be built at Vancouver, W. T., larger than any mill now there. The Vancouver, Klickitat & Yakima Railroad, of which five miles have been built, runs through a belt of fine virgin timber, a few miles from Vancouver, affording an excellent means of transporting logs to the mill.

The Smith-Hill Foundry and Machine Co., Quincy, Ill., have issued a new catalogue of machinery and machines made at the works. The company manufacture engines, boilers, feed-water heaters, pulleys, shafting and couplings, link belting, etc., and sell a large variety of boiler fittings and appliances, pipe, etc.

The Western Rapid Type Writer Co., Findlay, Ohio, whose shops were recently burned, have bought other shops, which Manning, Maxwell & Moore, of New York, stocked with tools on a three days' notice. This latter firm has recently shipped a complete machine shop outfit to the Thomson-Houston Carbon Co., Fremont, Ohio.

The Niagara River Iron Company's extensive plant at Ironton, below Tonawanda, N. Y., which has been standing idle for the past eleven years, has been leased by the bondholders to parties interested in iron manufacture in Western Ohio. The lessees will put the plant in order, and blow in as soon as possible for the manufacture of pig iron. The property represents an investment of over $400,000.

The Edison General Electrical Company has been organized. The works will be located in West Orange. The capital is put at $12,000,000. The new company will include the Edison Lamp Company, Edison Machine Works, Edison Electric Light Company, and Bergman & Co. Under the new consolidation, it is proposed to do away with all local companies, and to have plants in cities all over the country operated by the new company. Besides this, the separate business of each of the consolidated companies will be continued.

The Victoria Iron Furnace and Mines, situated at Goshen, on the line of the Chesapeake and Ohio Railroad, with a capacity of 200 tons of iron daily, owned by an English syndicate, have been leased by the attorneys of the company to Chamberlain, Wheeler & Co., of Columbus, Ohio. The plant will be put in operation at once. The furnace company's railroad, furnaces and mines employ over 1,000 hands. The furnaces consume 200 tons of coke a day. About six years ago this plant suspended operations, owing to litigation, and depression in the iron market.

Machinists' Supplies and Iron.

NEW YORK, Jan. 12, 1889.

Iron—American Pig—The market has ruled quiet, the buying having been chiefly of a hand-to-mouth character. There have been no changes in quotations, though a disposition is shown to shade prices. We quote Standard Lehigh and North River brands, No. 1 X Foundry, $18; No. 2, $17; Grey Forge, $16.

Scotch Pig—We quote Coltness, $20.50 to $21; Gartsherrie, $20; Summerlee, $20.50; Eglinton, $19 to $19.25; Dalmellington, $19.50 to $20; Clyde, $20.50, and Langloan, $20.50.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—See bottom of third column, page 11.

A mech. draftsman with exp. wants position. New York or vicinity preferred. O. T., AM. MACHINIST.

Wanted by practical machinist, situation in first-class jobbing shop. Address A. J., AM. MACHINIST.

Wanted by practical boiler maker, position as foreman; over 20 years' experience; have references. B. M., AMERICAN MACHINIST.

Position wanted as draftsman; experienced in iron structural, bridge and architectural work; also in general mach'y. Best ref. R. V., AM. MACHINIST.

Young Swede, technical school graduate, 6 years' shop experience, wants situation as assistant draftsman. Address G. O., AMERICAN MACHINIST.

Wanted—A good mechanic and business manager, to take $5,000 to $10,000 interest in a good Iron Works in California, doing well; all young and practical men connected. A. B. C., Oakland, Cal.

A mechanical engineer of 20 years' exp. desires engagement. Had extensive shop and drawing office exp. on general machine work. Is also boiler and engine expert. Address Newbold, care AM. MACHINIST.

A first-class draftsman and mechanical engineer wants position with some responsibility and prospects for advancement; graduate of polytechnicum abroad; 8 years' exp. in water-power and pumping mach., locomotives, steam eng. compound and triple exp.; energetic and accurate; best references. Address R., 30, AMERICAN MACHINIST.

Wanted—A first class machinist as assistant foreman in our shops; only those thoroughly familiar with the manufacture of wood-working machinery need apply. A young man who is smart, energetic and ambitious preferred. A good opening for right man and good prospects for future advancement. Address E. & B. Holmes, 59 Chicago st., Buffalo, N. Y.

Wanted—A shop superintendent with good executive ability to manage 100 men. He must be well acquainted, by long experience, with machine-tool building and with press and die work, with a thorough knowledge of jigs, and other special tools, in their adaptation to cheapening production. Address, stating age, experience and former locations, "P. D. M.," care of "AMERICAN MACHINIST."

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent Boiler Tube Expander; second to none; price in reach of all. Crescent Mfg. Co., Cleveland, O.

The Crescent Link Belt Coupling; something new; sample free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., consulting engineer for hydr. and pumping machinery, etc.

Punches, Dies and special machinery built to order. C. F. Langston & Co., 70 N. 4th St., Phila., Pa.

Specifications and drawings for machinery. D. J. Kelsey, M. E., 32 Ins. Bld., New Haven, Ct.

Correspondence solicited with parties having machine or foundry specialties to build. Honesdale Iron Works, Honesdale, Pa.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Wanted.—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

Manufacturers desiring to perfect their machines or to build special machinery, jigs, etc., for the manufacture of same will find first class ability and large experience by addressing, Hadwen Swain, Machine Designer, 1008 Jones st., San Francisco, Cal. Inventions perfected.

RATCHETS, WRENCHES, DRILLS.
LOWELL WRENCH CO.,
WORCESTER, - - MASS.

Save Money by Using
Nicholson's Patent Expanding Lathe Mandrels.

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TANITE EMERY WHEELS and GRINDING MACHINES
FOR SAW MILLS, FOUNDRIES AND MACHINE SHOPS
For Circulars address
THE TANITE COMPANY, STROUDSBURG, MONROE CO., PA.
Or H. A. ROGERS, 19 John St., N. Y.

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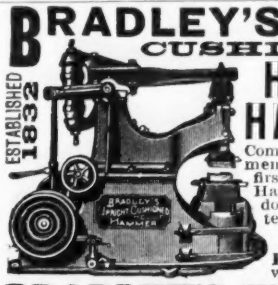

Combines the best elements essential in a first-class **Hammer.** Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the world.

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ESTABLISHED 1832

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With a manufacturing experience of over half a century, we recommend these machines to be the best, simplest, most durable and combining all the essential elements. **For hard coal or coke.** Indispensable in all shops to keep Bradley's Cushioned Hammers and men fully employed and reduces cost of production.

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—COMPOUND—
Automatic Water Heater.

Heats water to 212°, without pressure. With pressure will heat water to 320°.

NO COST FOR FUEL. UTILIZES WASTE HEAT. NO SWEATING. NO CORROSION. SAVES FROM 15 TO 25 PER CT. OF FUEL.

The most perfect and effective Feed Water Heater ever devised.

SEND FOR CIRCULAR.

THE HUSSEY RE-HEATER
—AND—
STEAM PLANT IMPROVEMENT CO.
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A. S. HATCH, Pres. S. D. BREWER, Gen. Man.

FOR SALE. CORLISS ENGINES.

The Fishkill Landing Machine Co., located at **Fishkill, on the Hudson, N. Y.,** offer to manufacturers and others desiring a well-built, economical and durable engine, their improved **CORLISS ENGINES.** They are endorsed by many reputable engineers and persons using them. Address as above.

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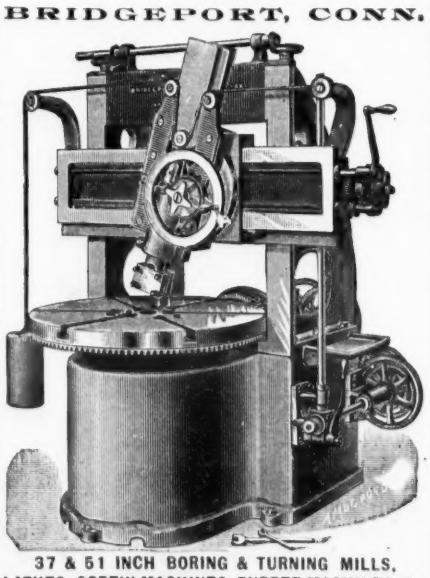

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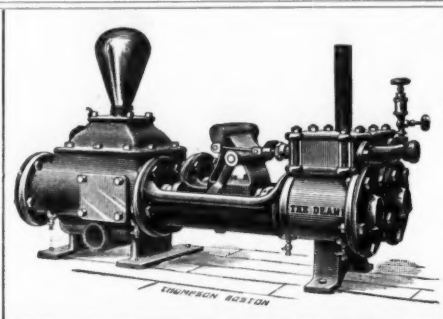
STEAM and POWER
PUMPS
FOR ALL PURPOSES.



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THE HENDEY 18-INCH ENGINE LATHE
Combines modern design with superior workmanship at a moderate price. No extra charge for Compound Rest, Hollow Spindle or Power Cross Feed. Length of beds, 6, 8, 10, 12, 14 and 16 feet. Have other sizes of Lathes; also, Shapers, Planers, &c. Send for Catalogue and Prices.
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IT PAYS TO USE THE BEST.
That is why **CRESCENT EXTRA STEEL** is found in so many well managed shops where results are closely watched.
For general machine shop tools and dies it is the most satisfactory steel you can get anywhere.
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OUR SPECIALTIES, 8, 12, 14 and 18 inch Lathes.

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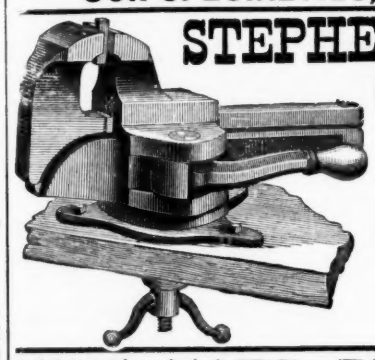

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Stationary or Patent Swivel Bases.
INCOMPARABLE FOR STRENGTH, DURABILITY FIRM HOLD AND QUICK WORK.
Has improved Taper, Pipe and other attachments. Made in 2, 2¾, 3½, 4½, 5½, and 6½ inch width of jaw.
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OUR NEW **CATALOGUE OF TOOLS**
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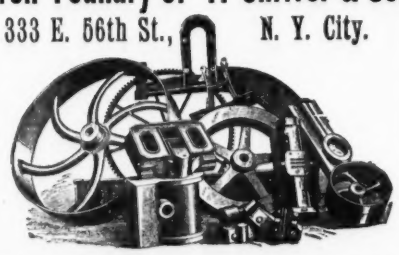

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CASTINGS IN QUANTITY AT FAVORABLE PRICES.

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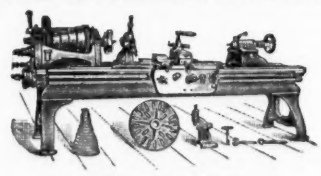

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IF YOU WANT A STRONG, ECONOMICAL
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EITHER HORIZONTAL OR VERTICAL,
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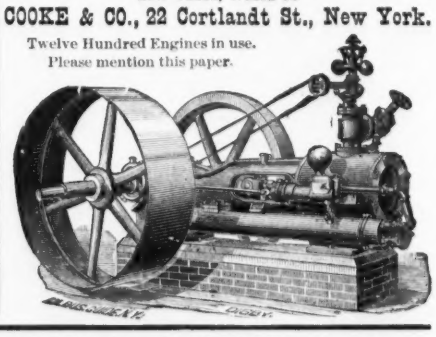

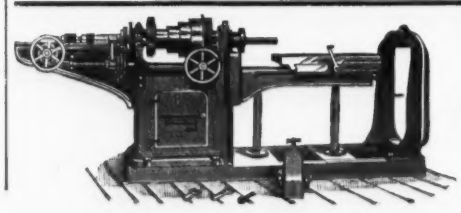

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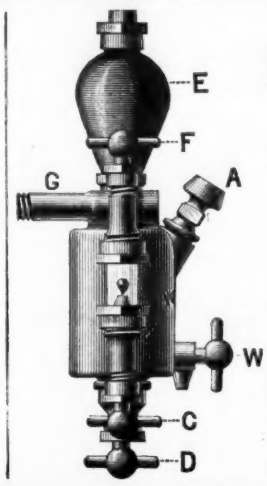

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Nos.	1	2	3
Price	$10.00	$12.00	$15.00
Capacity	⅓ pt.	½ pt.	¾ pt.

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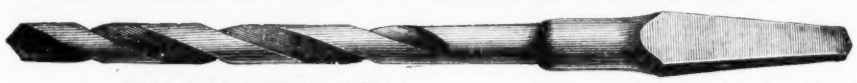

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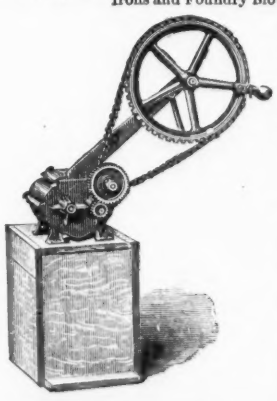

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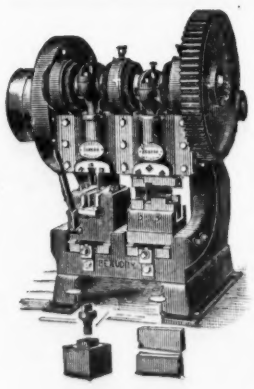

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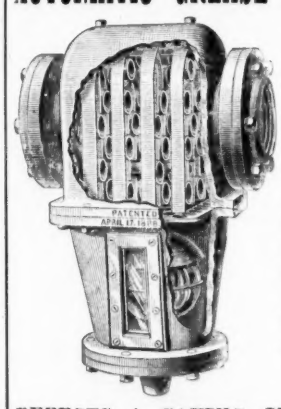

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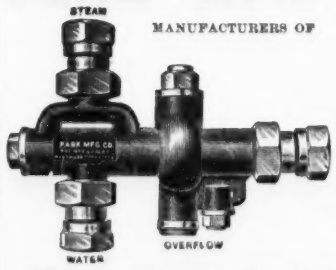

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Amateur's Size.
Taking anything from ⅛ to 1 inch inclusive.
Price,.....$5.00
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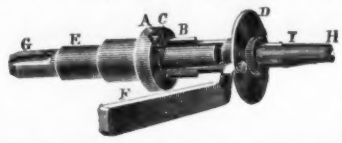

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Dean Bros Steam Pump Works.
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Boiler Feeders. Duplex Pumps,
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MANUFACTURED BY
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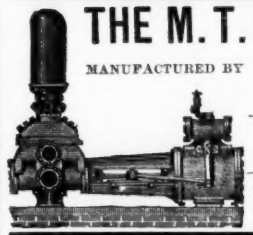

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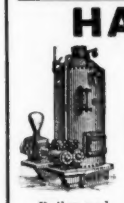

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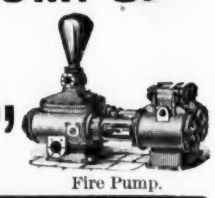

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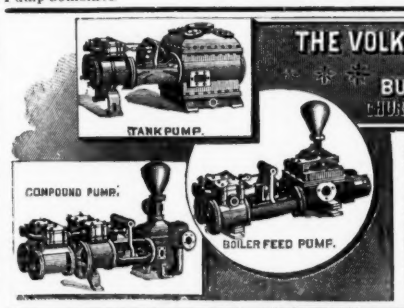

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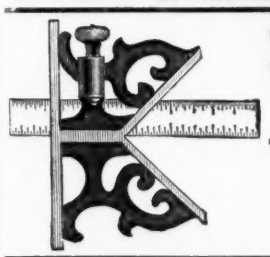

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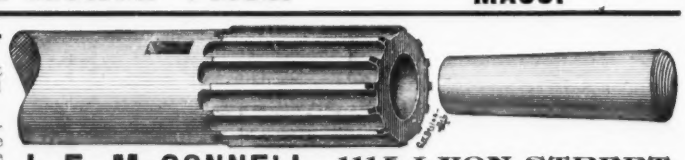

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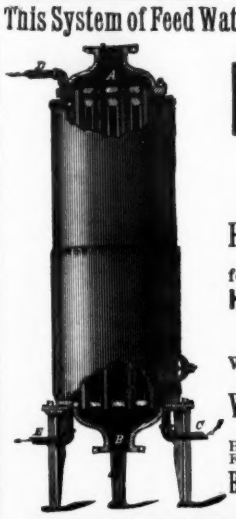

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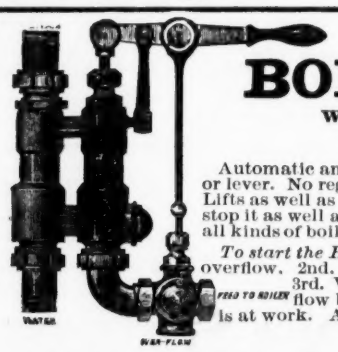

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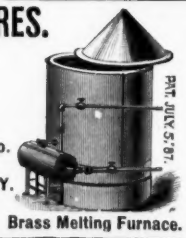

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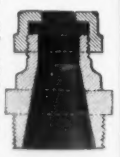

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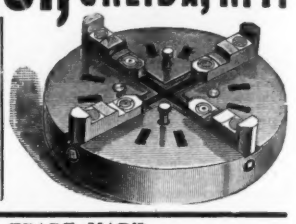

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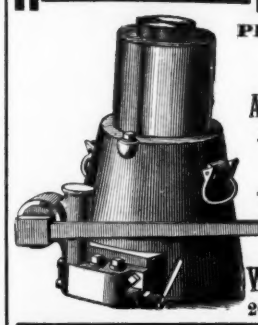

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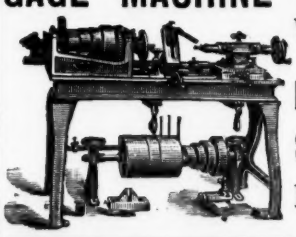

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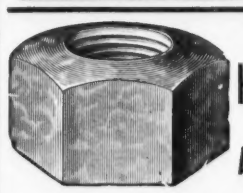

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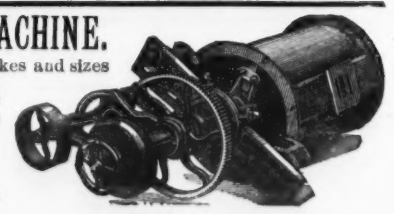

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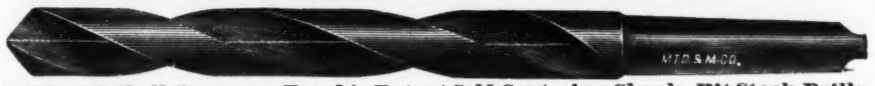

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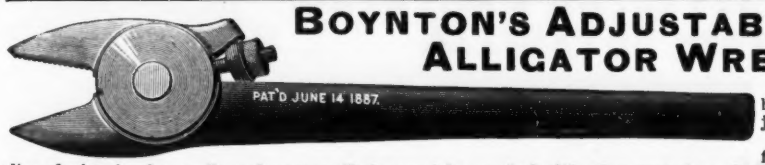

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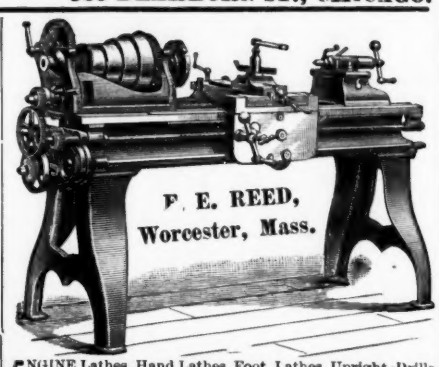

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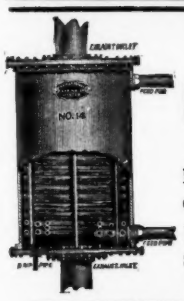

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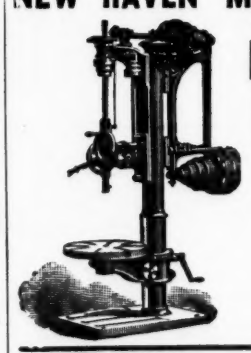

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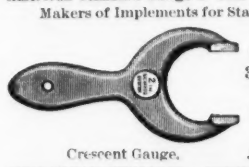

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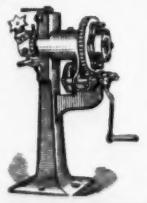

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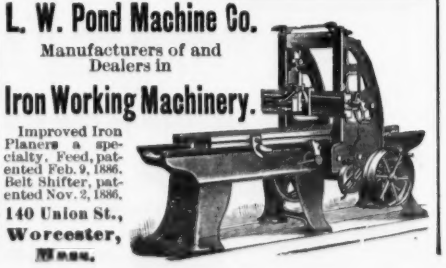

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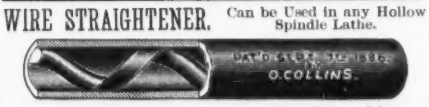

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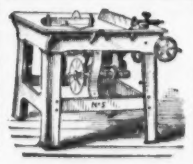

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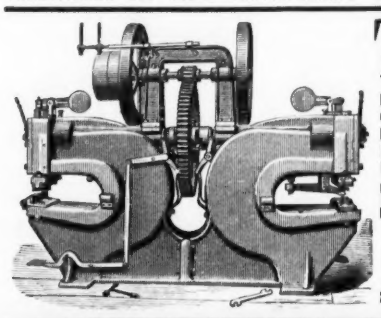
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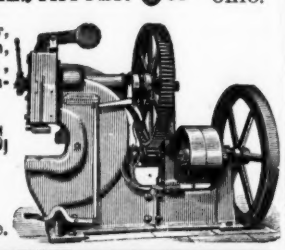

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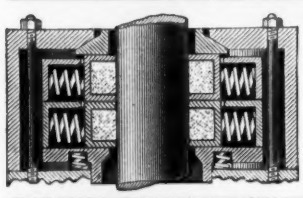
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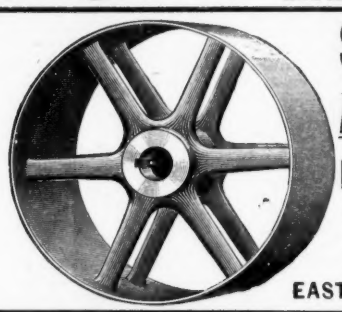
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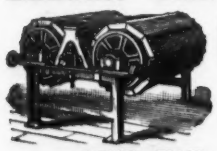
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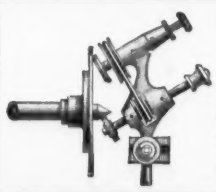
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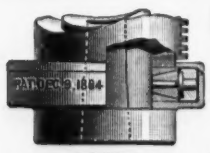
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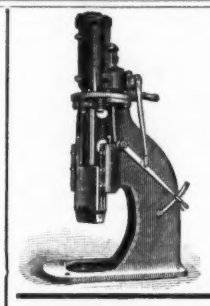
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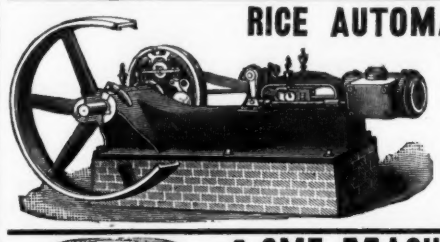
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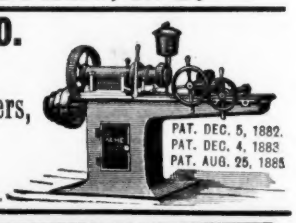
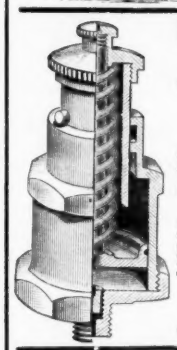

PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883
PAT. AUG. 25, 1885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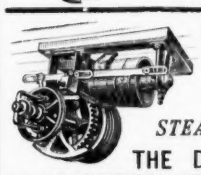
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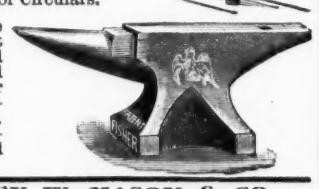

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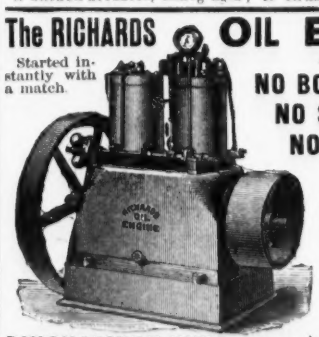
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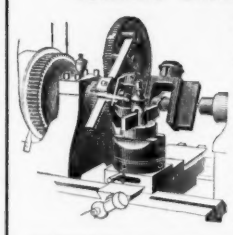
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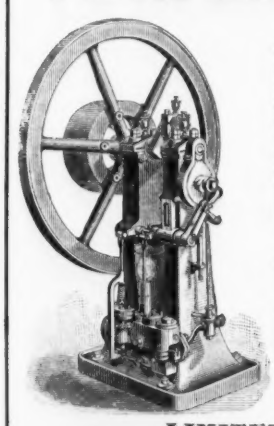
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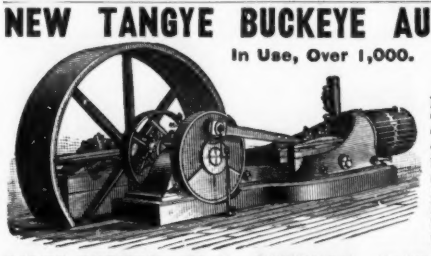

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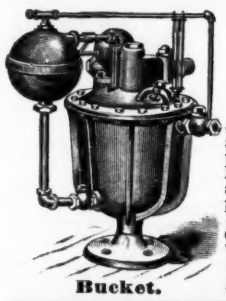

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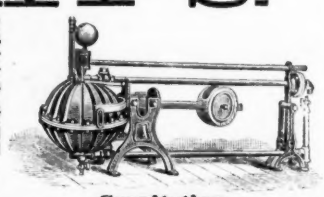

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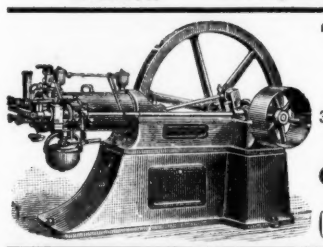

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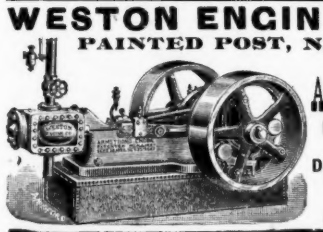

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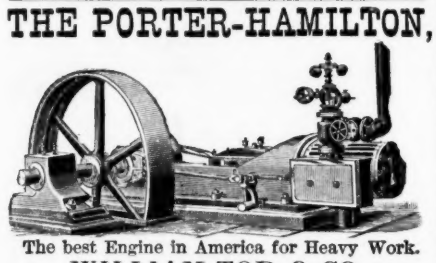

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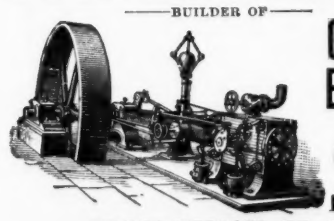

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16 in. x 42 in.	Planer.	Bridgeport,	new
20 in. x 5 ft.	"	Lincoln,	cheap
20 in. x 5 ft.	"	P. & W.,	good.
23 in. x 5 ft.	"	Hendey,	new.
22 in. x 5 ft.	"	Powell,	"
24 in. x 6 ft.	"	Powell,	"
30 in. x 8 ft.	"	each Atherton, Powell & H. & P.	new.
6-8-10-12-15 in. Crank Shapers.			
15 x 20 in. Friction Shapers.			
20-24-26 and 32 in. Geared Shapers.			
12 in. x 5 1-2 ft. Engine Lathe,		S. M. & Co.	new.
12 in. x 6 ft.	"	Young,	"
13 in. x 6 ft.	"	Ames,	"
14 in. x 6 ft.	"	Blaisdell,	"
14 in. x 7 ft.	"	Bogart,	"
14 in. x 6 ft.	" Gap Bed,	S. M. & Co.,	"
15 in. x 6 and 8 ft.	"	Porter,	"
16 in. x 6 and 8 ft.	"	Blaisdell,	"
16-20 in. x 6-8-10 & 12 ft.		Bridgeport,	"
18 in. x 8-10-12 ft.	"	Different Makes,	"
20 in. x 8-10-14 ft.	"	Different Makes,	"
20 in. any length Bed	"	Bridgeport,	"
22 in. x 12 ft.	"	Niles,	heavy, good.
23 in. x 8-10-12 & 14 1 2	"	Bridgeport,	new.
28 in. x 14-16 & 18 ft. Engine Lathes,		T. & S.	"
20 in. Drill		Davis,	"
20-23-25-28 inch Drills		Blaisdell,	"
20-25-28-32 inch	"	C. & S.	"
5 ft. Arm Universal Radial Drill,			"
Cabinet Turret Lathe, Lodge, Davis & Co.			"
No. 5 Screw Machine, Jones, Lamson & Co.			"
No. 2 4	"	Brown & Sharpe.	"
No. 2 and 4 Stiles Punch Press,			good
Ames Index Milling Machine,			fair.
No. 2 Garvin Hand Miller,			A 1.
No. 5 Brainard	"		A 1.
Lincoln Pattern,	"		good order.
No. 1 and 3 Universal Miller, Brown & Sharpe,			new.
No. 1 2 and 5 Plain	" " " "		"
No. 1 Universal Grinder,	" "		"
No. 3 Surface Grinder,	" "		A 1.

Cold Rolled Shafting in Stock. Send for list. Write for what is wanted.

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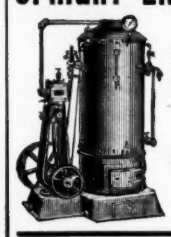

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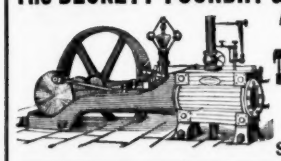
Manufacturers of



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Almond Drill Chuck

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We have opened at 23 and 25 Purchase St., Boston, in connection with Messrs. Chandler and Farquhar of that city, a depot for the exhibition and sale of our Improved Engine Lathes, Shapers, Drill Presses and Brass Working Machine Tools, &c. We make a feature of Complete Engine Lathes, without charge for extra attachments.

Call and examine them. Cuts, with full descriptions, free.

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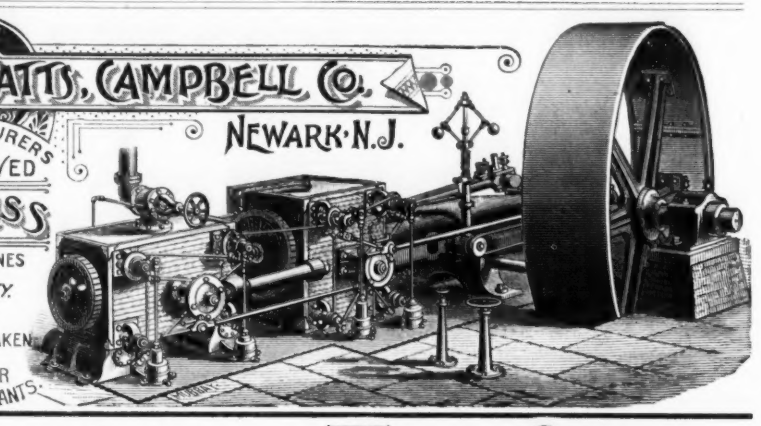

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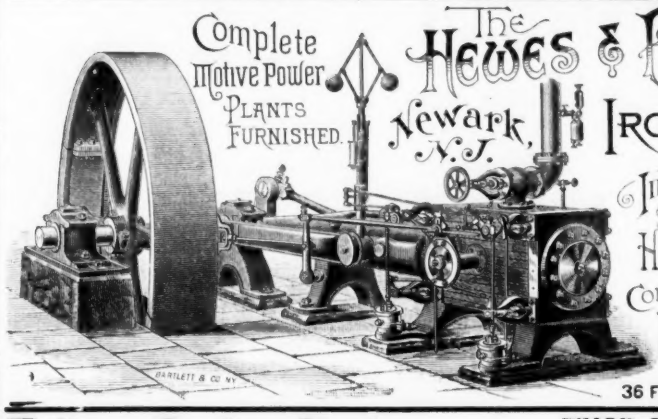

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TUBULAR BOILERS.

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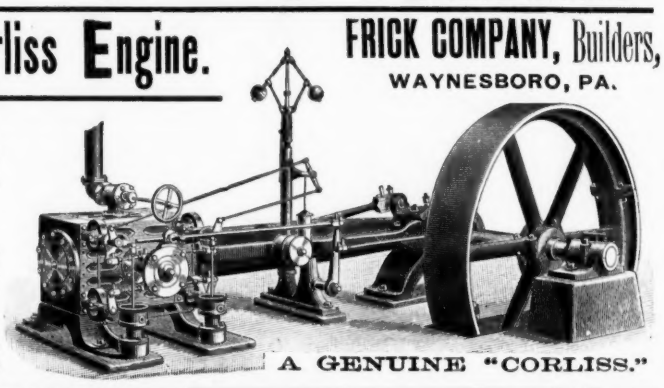

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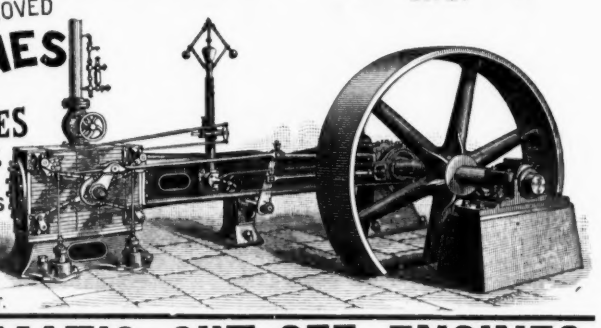

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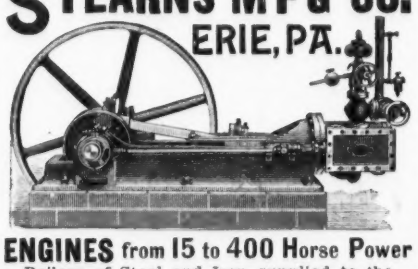

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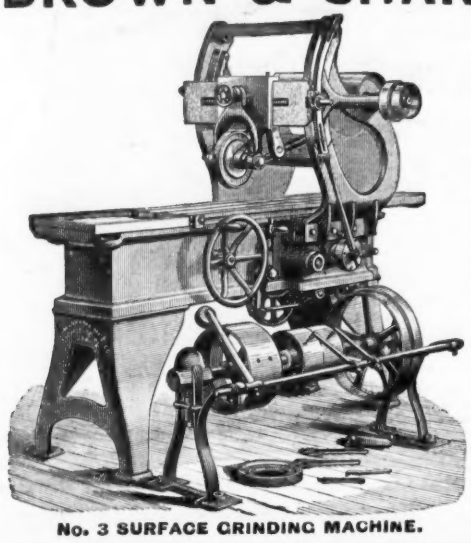

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Manufacturers of

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This Machine is designed for flat and true surface grinding and finishing. It is an effective substitute for the operations of filing and stoning. The entire cost of files, and three-quarters of the labor usually expended on these operations are saved, besides obtaining better surfaces upon the work done. For all finished parts of machinery of cast iron or steel, hard or soft, for punches or dies, straight edges, flattening dies, etc., it will prove invaluable, and will produce fine work with little expense.

It will Grind 14″ wide, 36″ long, 11½″ high, using a 9″ wheel. Weight, 2,500 lbs.

We are prepared to furnish this machine, lengthened, to grind 5 ft. long. Weight, 3,000 lbs.

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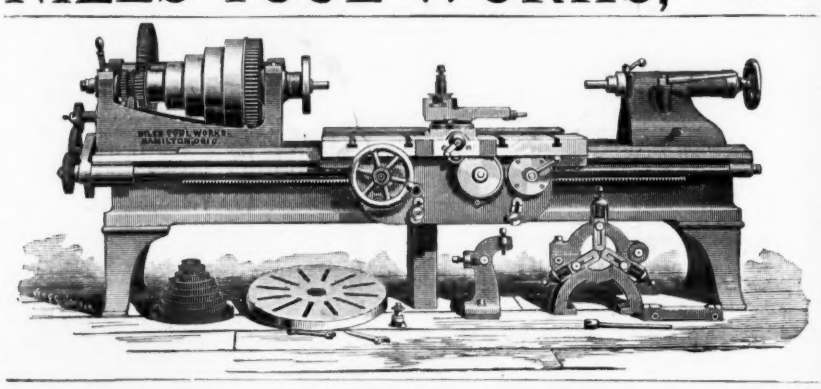

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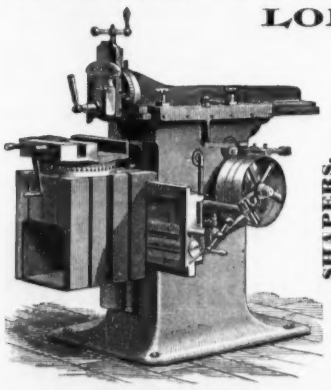

SHAPERS, 15″ and 20″ Crank, 20″, 26″, 32″ Geared.
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20 inch Upright Drills. 25 inch Back Geared,
24 " " " and
28, 32 and 40 inch Power Feed Drills.

WRITE FOR PRICES, IT WILL PAY YOU.

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Eberhardt's Patent

AUTOMATIC GEAR CUTTER.

18 in. 25 in. 36 in. 50 in. 60 in. 84 in. Sizes.

"Experts pronounced it the best."

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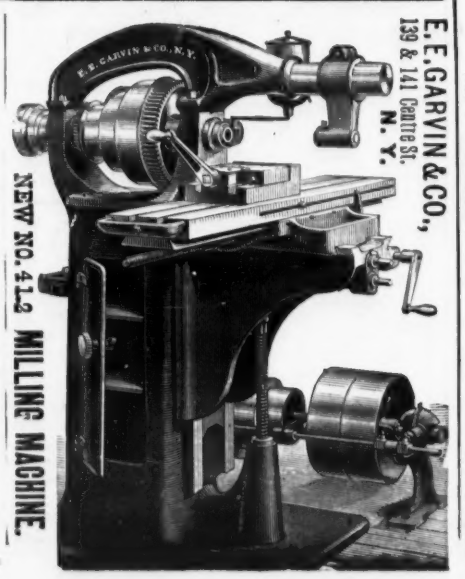

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NEW NO. 412 MILLING MACHINE.

THE PRATT & WHITNEY CO.,

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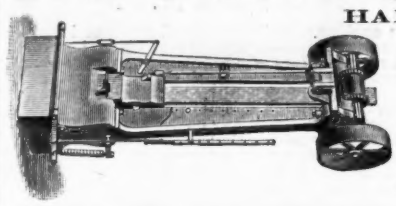

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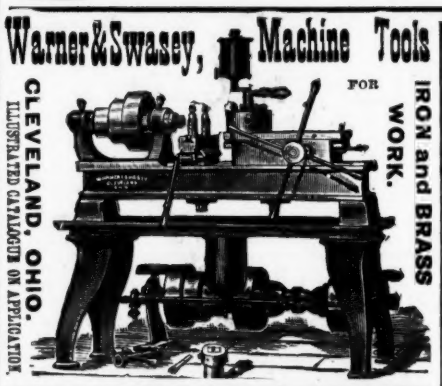

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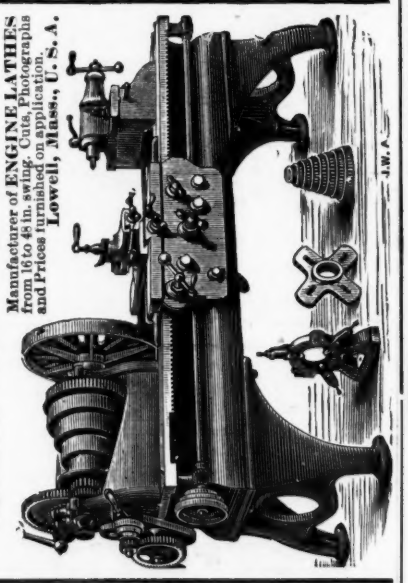

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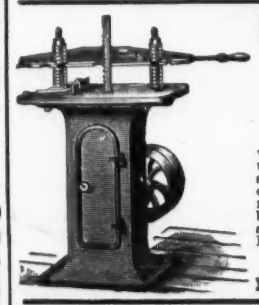

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Our Key-Seating Machine will save enough in 60 days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment both Key-Seating Machines and 20-in. Drills. Send for Photo. and Catalogue.

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All our tools are expressly designed for the economical manufacture of heavy machinery for railroad and general machine shop equipment, from new patterns of the latest and best designs.

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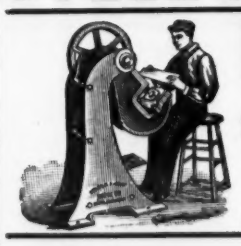

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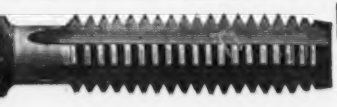

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